DRAFT SUPPLEMENT NO. 1 TO THE 1982 YAZOO AREA PUMP PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT

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FINAL ENVIRONMENTAL IMPACT STATEMENT

The responsible lead agency is the U.S. Army Engineer District, Vicksburg. The responsible cooperating agencies are the U.S. Fish and Wildlife Service and the Mississippi Department of Wildlife, Fisheries and Parks.

Abstract: The Yazoo Backwater Area is located in west-central Mississippi immediately north of Vicksburg, Mississippi. The Backwater Area is bounded on the west by the left bank Mississippi River levee, the Yazoo Basin escarpment on the east, and the Yazoo River on the south. The Backwater Area is the area that has historically been subject to flooding from backwater from the Mississippi River. The area is also subject to headwater flooding from the Yazoo River, Sunflower River, and Steele Bayou. The Backwater Area is divided into five subareas: (a) the Satartia Area, (b) the Satartia Extension Area, (c) the Rocky Bayou Area, (d) the Carter Area, and (e) the Yazoo Area. Only the Yazoo Area is considered in detail.

The recommended plan is a 14,000-cubic-foot-per-second diesel pumping station, with a year-round pump elevation of 87 feet, National Geodetic Vertical Datum, at Steele Bayou. The nonstructural flood damage reduction features include voluntary conservation easements and the reestablishment of bottom-land hardwoods on 62,500 acres of open land below the pump elevation. Also included is the modification of the operation of the Steele Bayou drainage structure to maintain water in existing water bodies between 70-73 feet, National Geodetic Vertical Datum, at Steele Bayou during low-water periods. The first cost of this plan is $181.6 million with an annual cost of $14.9 million and annual operation and maintenance cost of $995,000. The benefit-cost ratio for the recommended plan is 1.4.

If you would like further information on the supplement, please contact:

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NOTE: Information, displays, maps etc., discussed in the Main Report and appendixes are incorporated by reference in the Supplemental Environmental Impact Statement.

SUPPLEMENT NO. 1 TO THE 1982 YAZOO AREA PUMP PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

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DRAFT SUPPLEMENT NO. 1 TO THE 1982 YAZOO AREA PUMP PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT

INTRODUCTION

1. Proposed construction changes, substantial environmental concerns, and additional significant environmental information concerning the Yazoo Backwater Area Project required reevaluation of the environmental effects. This draft Supplemental Environmental Impact Statement (DSEIS) supplements the 1982 Yazoo Area Pump Project, Final Environmental Impact Statement, Flood Control, Mississippi River and Tributaries, Yazoo Basin, Mississippi. The Record of Decision was signed in July 1983. The current DSEIS is an integral part of the reformulation report and furthers the purposes of the National Environmental Policy Act (NEPA).

2. This DSEIS is an analytical, self-supporting document that informs decision makers and the public. It defines current environmental issues, evaluates an array of alternatives, and addresses measures to avoid, minimize, and compensate unavoidable impacts, where appropriate. The Main Report, terrestrial, aquatic, waterfowl, wetlands, water quality, Section 404(b)(1), endangered and threatened species, cultural resources, and engineering appendixes support this DSEIS and are referenced extensively. The Main Report and appendixes, and the information they contain, are an integral part of the DSEIS and are incorporated by reference. The reader is encouraged to reference these appendixes for specific methodologies and detailed information.

MAJOR CONCLUSIONS

3. The recommended plan reduces average annual flood damages to urban and agricultural areas through a combination of structural and nonstructural flood damage reduction measures, minimizes adverse impacts through project design, and provides a net gain in environmental value to the Yazoo Backwater Area (Plate 4-1). This plan represents a balanced approach to addressing the flood damage reduction and environmental opportunities in the Yazoo Backwater Area.

4. The recommended plan is Plan 5. The estimated cost of the plan is $181,595,000, with a benefit-cost ratio of 1.4. The plan includes a 14,000-cubic-foot-per-second (cfs) pump with a year-round pumping elevation of 87 feet (1-year flood plain), National Geodetic Vertical Datum (NGVD), at the Steele Bayou structure and acquisition of conservation easements (from willing sellers) and reforestation on 62,500 acres of agricultural land below 87 feet, NGVD. The pump provides structural flood damage reduction above 87 feet, NGVD, and the reforestation provides nonstructural flood damage reduction below 87 feet, NGVD. Operation of the Steele Bayou structure would also be modified to maintain a 70- to 73-foot elevation during low-water periods. This would make available more water in the Steele Bayou channel during critical low-water periods.

5. Although adverse effects to environmental resources would result from the operation of the pump, the nonstructural flood damage measure (reforestation) provides substantial environmental benefits. The net effect of the structural and nonstructural flood damage reduction measures is a net increase of 18.7 percent in aquatic resource value, 23.5 percent increase in wetland resource value, 17.4 percent increase in terrestrial resource value, and a 42.1 percent decrease in waterfowl resource foraging value. Reforestation accounts for 91 percent of the foraging value loss (soybeans and rice have a higher foraging value than bottom-land hardwoods). Although reforestation results in a foraging loss, reforestation provides other waterfowl habitat requirements that are notably absent in agricultural fields. The overall benefit from reforestation far exceeds the loss in foraging habitat (Appendix 11).

AREAS OF CONTROVERSY

6. The approach to addressing the study area's problems and opportunities is an area of controversy. Traditionally, most flood control needs and opportunities have been addressed through structural flood damage reduction measures. However, consideration of nonstructural flood damage reduction measures has become increasingly common. The controversy is whether the solution should be an entirely nonstructural approach, a combination structural and nonstructural approach, or an entirely structural approach.

UNRESOLVED ISSUES

7. Except for remaining compliance requirements discussed in paragraph 8, there are no unresolved issues for this stage of planning.

RELATIONSHIP TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

8. The relationship of each alternative to the requirements of environmental laws, executive orders, memorandums, land use plans and permits was evaluated (Table SEIS-1). The Clean Water Act, Executive Order on Flood Plain Management, Executive Order on Wetlands, and requirements for hazardous, toxic, and radioactive wastes are of particular importance.

CLEAN WATER ACT

9. The Section 404(b)(1) evaluation concluded that the proposed disposal sites are in compliance with the Environmental Protection Agency (EPA) guidelines (Appendix 3). The three proposed disposal sites are located at the pump site (Plate 4-46) Approximately 38 acres of bottom-land hardwood wetlands, 110.5 acres of cleared, and 5.2 acres of open water would be impacted by disposal activities. Pursuant to Section 404 of the Clean Water Act, a public meeting to address project planning and to provide the opportunity for public comment will be conducted. The nonstructural reforestation feature fully offsets the environmental losses associated with the disposal areas. A joint Public Notice with the State of Mississippi will be issued to solicit comments on the potential effects to wetlands and waters of the United States. A Section 401 water quality certificate must be obtained from the State of Mississippi before construction.

EXECUTIVE ORDER ON FLOOD PLAIN MANAGEMENT

10. Executive Order 11988 directs Federal agencies to reduce flood loss risk; minimize impacts on human safety, health and welfare; and restore and preserve the natural and beneficial values

TABLE SEIS-1
ENVIRONMENTAL PROTECTION STATUTES AND REQUIREMENTS

Item	Alternative Compliance					
	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7
Federal Statutes Archeological and Historic Preservation Act, as amended, 16 U.S.C. 469, et seq.	Partial	Partial	Partial	Partial	Partial	Partial
Clean Air Act, as amended, 42 U.S.C. 7401, et seq.	Partial	Partial	Partial	Partial	Partial	Partial
Clean Water Act, as amended (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Partial	Partial	Partial	Partial	Partial	Partial
Coastal Zone Management Act, as amended, 16 U.S.C. 1451, et seq.	NA	NA	NA	NA	NA	NA
Endangered Species Act, as amended, 16 U.S.C. 1531, et seq.	Partial	Partial	Partial	Partial	Partial	Partial
Estuary Protection Act, 16 U.S.C. 1221 et seq.	NA	NA	NA	NA	NA	NA
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(2), et seq.	Full	Full	Full	Full	Full	Full
Fish and Wildlife Coordination Act, as amended, U.S.C. 661, et seq.	Full	Full	Full	Full	Full	Full
Land and Water Conservation Act, as amended, 16 U.S.C. 4601, et seq.	NA	NA	NA	NA	NA	NA
Marine Protection, Research and Sanctuaries Act, 22 U.S.C. 1401, et seq.	NA	NA	NA	NA	NA	NA
National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq.	Partial	Partial	Partial	Partial	Partial	Partial

TABLE SEIS-1 (Cont)

Item	Alternative Compliance					
	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq.	Partial	Partial	Partial	Partial	Partial	Partial
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	Full	Full	Full	Full	Full	Full
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	NA	NA	NA	NA	NA	NA
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq.	NA	NA	NA	NA	NA	NA
Farmland Protection Policy Act	Partial	Partial	Partial	Partial	Partial	Partial
Executive Orders, Memorandums, etc. Flood Plain Management (E.O. 11988)	Full	Full	Full	Full	Full	Full
Protection of Wetlands (E.O. 11990)	Full	Full	Full	Full	Full	Full
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	NA	NA	NA	NA	NA	NA
State and Local Quality Standards Mississippi Water Quality Standards	Partial	Partial	Partial	Partial	Partial	Partial

Notes: Compliance categories:

a. Full Compliance. All requirements have been met for this stage of planning.
b. Partial Compliance. Some requirements remain to be met for this stage of planning.
c. Noncompliance. None of the requirements have been met for this stage of planning.
d. Not Applicable. Statute, E. O., or other policy not applicable.

served by flood plains. Agencies must consider alternatives to avoid adverse and incompatible development in the flood plain. If the only practical alternative requires action in the flood plain, agencies must design or modify their action to minimize adverse impacts.

11. Plan formulation included no-action, nonstructural, structural, and combination structural and nonstructural plans. Any solution to reduce flood damages in the study area must occur in the flood plain. The recommended plan minimizes adverse effects to environmental values from the structural flood damage reduction measure by initiating pumping at elevation 87 feet, NGVD (compared to the structural only plan which initiates pumping at 80 feet, NGVD). The nonstructural flood damage reduction measure (reforestation of 62,500 acres) reduces flood loss risk (removes potential crop damage) and provides a net increase to the natural and beneficial values served by the flood plain.

EXECUTIVE ORDER ON WETLANDS

12. Executive Order 11990 directs Federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands if a practical alternative exists. Furthermore, agencies shall consider the action's effect on (a) public health, safety and welfare, (b) maintenance of natural systems, including conservation and long-term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources, and (c) other wetland uses.

13. Impacts from the structural component were avoided by increasing the pumping elevation to 87 feet, NGVD. The recommended plan results in a 23.5 percent increase in wetland resource value in the study area.

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

14. The Vicksburg District conducted an onsite hazardous, toxic, and radioactive wastes (HTRW) assessment of the pump site on 31 July 1998 (Appendix 6). No indicators of hazardous wastes were observed. A records search of the Mississippi Office of Pollution Control indicated no known or potential sites within a 1-mile radius of the pump site. Based on this assessment, the risk of encountering HTRW during construction was determined to be low.

15. HTRW assessments of the easement properties will be conducted after they have been identified and prior to any real estate transaction.

NEED FOR AND OBJECTIVES OF ACTION

16. Congress, the Corps of Engineers, and the Board of Mississippi Levee Commissioners are responding to the need for urban and agricultural flood protection.

AUTHORITY AND DIRECTION

17. The Yazoo Basin, Yazoo Backwater, Mississippi, Project was authorized by the Flood Control Act (FCA) of 18 August 1941 (HD/359/77/1), as amended by the Acts of 22 December 1944 and 27 October 1965 (HD/308/88/2) and the Water Resources Development Acts of 1986 and 1996. Authorized flood control measures include levees, associated drainage channels, pumping plants and floodgates. The Yazoo Backwater Area is divided into five subareas: (1) Satartia Area, (2) the Satartia Extension Area, (3) Rocky Bayou Area, (4) the Carter Area, and (5) the Yazoo Area (Plate 4-1). Only the Yazoo Area is considered in detail in the DSEIS. See the Main Report for details concerning the elimination of the other areas.

18. The FCA of 1941 authorized the extension of the east bank Mississippi River levee along the west bank of the Yazoo River for a distance of about 54 miles to a connection with Yazoo River levee feature of the Yazoo Basin Headwater Project in the vicinity of Yazoo City, Mississippi. A drainage structure was included at Little Sunflower River, and a combination drainage structure and pumping plant was included at Big Sunflower River, Deer Creek, and Steele Bayou with a total capacity of 14,000 cfs. The Act also provided for the enlargement of 7 miles of levee in the Rocky Bayou Area and the adjustment of grades of existing levees on the east bank of the Yazoo River. The Act provided that the Chief of Engineers shall fix the grade of the extension levees so that their construction will give the maximum practicable protection to the Yazoo Backwater area without jeopardizing the safety of the mainline Mississippi River levees.

19. The FCA of 1944 extended the project to include 38 miles of levees on the east bank of the Yazoo River (Satartia and Satartia Extension Areas).

20. As a result of the Comprehensive Review of the Mississippi River and Tributaries Project Report, 6 April 1962 (HD 308/88/2), the Chief of Engineers modified the authorized plan to include a connecting channel between Sunflower River and Steele Bayou, with all interior drainage evacuated through the Little Sunflower and Steele Bayou structures. Included in the recommended plan was the fee title acquisition of 70,000 acres in the sump areas and the operation of the sump areas to produce optimum flood control and fish and wildlife benefits. These modifications were authorized by the FCA of 1965.

21. In 1970, the Yazoo Backwater Area Project was modified to include the Muddy Bayou Structure under the discretionary authority of the Chief of Engineers. This was accomplished in response to a 1969 report prepared to determine the impacts of completed and authorized flood control works on the fisheries and water quality of Eagle Lake. The structure allows manipulation of lake levels for improvement of water quality and fishery resources.

22. The 23 July 1976, Yazoo Basin, Yazoo Backwater Area, Fish and Wildlife Mitigation Plan report proposed the implementation of an increment of structural measures to mitigate fish and wildlife losses resulting from the constructed flood control works in the backwater area. The plan recommended the construction of nine greentree reservoirs (GTR's) and nine slough impoundments on Delta National Forest under the discretionary authority of the Chief of Engineers. These features were approved by the Chief of Engineers in December 1976. During the design phase, and with concurrence of the U.S. Forest Service, the nine GTR's were reduced to four, and the nine slough control structures were reduced to five. Four of the slough control structures and one of the GTR's were eliminated due to unsuitable site conditions. One additional GTR was deleted because of problems with an existing easement. Three GTR's were eliminated because the U.S. Forest Service informally indicated they did not want more GTR's built. Therefore, only four GTR's and five slough control structures were constructed.

23. A reevaluation of the economic feasibility of the pumping stations feature of the Yazoo Backwater Area Project was completed by the Vicksburg District in 1982. The results are in the Yazoo Basin, Yazoo Backwater Area, The Yazoo Area Pump Project Main Report and Final Environmental Impact Statement, July 1982, and revised November 1982. The recommended plan included a 17,500-cfs pumping station. In conjunction with reevaluation efforts, the Yazoo Area Pump Project and Yazoo Area and Satartia Area Backwater Levee Project, Fish and Wildlife Mitigation Report, July 1982, was prepared. The report included mitigation recommendations for the connecting channel, drainage structures, and other appurtenances, as well as the recommended Yazoo Area Pump Project. The recommended plan was the acquisition of perpetual easements on 40,000 acres of wooded land. Thirty-three thousand acres were mitigation for construction of the Yazoo Area and Satartia Area levees. Six thousand five hundred acres were mitigation for the effects of the 17,500-cfs pumping station.

24. The Water Resources Development Act (WRDA) of 1986 authorized the acquisition of perpetual easements on 40,000 acres for mitigation as recommended by the July 1982 Reevaluation Report. WRDA 1986 also changed the cost-sharing provisions of local interests for Corps projects nationwide. The local sponsor would provide the lands, easements, rights-of-way, relocations and disposal areas for the project or 25 percent of the construction cost,

whichever is greater. The Rocky Bayou, Carter Area, and the uncompleted features of the Yazoo Area were all deemed separable elements of the Yazoo Backwater Area Project, and therefore, subject to the new cost-sharing provisions.

25. In October 1989, the Vicksburg District prepared the Yazoo Backwater Area, Mississippi, Yazoo Basin, Mississippi, Mitigation Plan Report. The report evaluated options for mitigating terrestrial wildlife losses associated with the Yazoo and Satartia Area levees. Fee-title acquisition and reforestation of 8,400 acres of frequently flooded agricultural lands was selected as the best plan to mitigate terrestrial wildlife losses in lieu of the mitigation approved by WRDA 1986. The plan was implemented with the acquisition and reforestation of the 8,800-acre Lake George property, now operated by the Mississippi Department of Wildlife, Fisheries and Parks as the Lake George Wildlife Management Area.

26. Directives from the Assistant Secretary of the Army (Civil Works) and the Director of Civil Works in January 1989 and February 1990 requested the Corps reformulate the project and identify, display, and evaluate alternative plans for the following:

a. Greater level of flood protection for urban areas.

b. Reduced levels of agricultural intensification.

c. Reduced adverse impacts on the environment.

27. The WRDA of 1996 modified the effective date for determining cost-sharing requirements. The Yazoo Backwater Area Project is no longer subject to cost-sharing provisions.

PUBLIC CONCERNS

28. Economic and environmental issues are primary concerns of public and private interests. Significant flood damage occurs to structures in the study area, creating health, safety, and social welfare problems. Flooding also adversely affects agricultural crops, local levees, drainage

systems, public roads and bridges, and agricultural support services. Natural resource conservation is a major public concern. Land clearing has significantly reduced bottom-land hardwood forests and the associated fish and wildlife resources.

29. There is a concern that the solution would emphasize flood control benefits at the expense of the environment or vice versa. Also, there is a concern that structural flood damage reduction would be emphasized over nonstructural flood damage reduction or a combination of structural and nonstructural measures. Increased public concern and environmental awareness dictate that project formulation and implementation should achieve, at a minimum, a no-net-loss of natural resources through a balanced approach to the flood control needs and environmental opportunities in the study area. A balanced approach should improve the lives of people who live in the area by providing a measure of flood control and improve the environment by changing land use through reforestation (nonstructural flood damage reduction) of the most flood-prone areas.

PLANNING OBJECTIVES

30. Planning objectives, developed through problem analysis and extensive public involvement, provided the basis for the formulation of alternatives, environmental design, impact assessment and selection of the recommended plan. Objectives included:

a. Reduced agricultural intensification.

b. Increased urban flood protection.

c. Reduced urban and agricultural flood damages.

d. Minimize impacts through environmental design.

e. Compensate 100 percent for the net unavoidable environmental effects.

f. Provide, at a minimum, no net loss of natural resources.

ALTERNATIVES

PRELIMINARY SCREENING

31. The affected public assisted in identifying and modifying project alternatives (Appendix 5). A public scoping meeting was conducted in Rolling Fork, Mississippi, in November 1993 to outline reformulation study procedures and receive public input concerning the study process. Additional briefings, meetings, and workshops were conducted to help identify and modify alternatives and build a consensus among interested parties (Table SEIS-2).

32. A broad range of flood protection alternatives was developed and evaluated by an interdisciplinary and interagency team representing design, formulation, engineering, hydrology, hydraulics, socioeconomic, and environmental disciplines. Each alternative was developed through a multiobjective process, satisfying specific identified concerns. Alternatives included no action, nonstructural, structural, and combination nonstructural/structural plans.

33. Nonstructural measures included the traditional measures (levees or walls around structures, flood forecasting, relocation, etc.), conservation easements to reforest agricultural lands, restrict future intensification of land use, and preserve existing forested areas. All easements would be from willing sellers and perpetual.

34. Traditional nonstructural measures to reduce flood damages were considered early in the screening process (Appendix 7). Measures included:

a. Construct walls or levees around structures.

b. Flood forecast and warning system with temporary evacuation.

TABLE SEIS-2
PUBLIC INVOLVEMENT AND CONSENSUS-BUILDING ACTIVITIES

Item	Participants	Location	Date
Public scoping meeting	Federal, state and local agencies; local government; environmental organizations; general public	Rolling Fork, MS	November 1993
Three public involvement workshops	Federal, state and local agencies; local government; environmental organizations	Jackson, Rolling Fork and Vicksburg, MS	May 1997
Briefing of public involvement workshop participants	Federal, state and local agencies; local government; environmental organizations	Vicksburg, MS	August 1997
Teleconference	Vicksburg District (CEMVK) and Environmental Protection Agency (EPA) staffs	Vicksburg, MS/Atlanta, GA	May 1998
CEMVK/Mississippi River Commission (MRC) briefing for EPA and U.S. Fish and Wildlife Service (FWS)	EPA, FWS, CEMVK, MRC staffs	Atlanta, GA	October 1998
Meeting	EPA, FWS, CEMVK, MRC and Assistant Secretary of the Army (civil Works) staffs	Washington D.C.	January 1999
CEMVK briefing for Congressman Thompson	CEMVK, Congressman Thompson and staff	Rolling Fork, MS	January 1999
FWS briefing for EPA, CEMVK, MRC	FWS, EPA, CEMVK, MRC	Vicksburg, MS	February 1999
FWS Planning Aid Letter	Not applicable (N/A)	N/A	March 1999
Consensus Committee Meeting	Federal, state and local agencies; local government; environmental organizations	Greenville, MS	March 1999

TABLE SEIS-2 (Cont)

Item	Participants	Location	Date
Consensus Committee Meeting	Federal, state and local agencies; local government; environmental organizations		April 1999
Consensus Committee Meeting	Federal, state and local agencies; local government; environmental organizations		May 1999
Consensus Committee Meeting	Federal, state and local agencies; local government		May 1999
Consensus Committee Meeting	Federal, state and local agencies; local government		June 1999
EPA briefing for FWS, CEMVK, MRC on Virginia Polytechnical Institute study	EPA, FWS, CEMVK, MRC, VPI staffs		
Consensus Committee Meeting	Federal, state and local agencies; local government	Raymond, MS	July 1999
FWS Planning Aid Report	N/A	N/A	September 1999
Consensus Committee Meeting	Federal, state and local agencies; local government	Raymond, MS	September 1999

c. Permanent flood plain evacuation.

d. Relocate structures and contents to flood-free area.

e. Provide replacement structures, relocate contents, and demolish existing structures.

f. Raise structures in place.

g. Waterproof walls and openings in structures.

35. Measures to reimburse for damages and/or reduce future damages included:

a. Acquisition of flood-prone property.

b. Flood plain regulation through zoning ordinances, regulations, and building codes.

c. Flood insurance.

36. Affected residential, commercial, and public structures are primarily slab-on-grade construction. Raising or relocating these structures is impractical through normal procedures and/or cost prohibitive, and these measures were screened from consideration. Structural waterproofing, wall or levee construction around structures, and property acquisition/demolition were not cost-effective and screened from consideration also. Flood forecasting and warning systems with temporary evacuation are being utilized currently and are not satisfactory. Floods in the study area are slow to occur and people have sufficient time to evacuate, but it can take months before they would be able to return. These nonstructural measures were not economically justified and were eliminated from further consideration (Main Report, Table 4).

37. All seven counties/parishes and 19 communities in the study area are participants in the National Flood Insurance Program. The unincorporated communities participate through their county or parish. This program provides subsidized flood insurance to property owners and mandates local government adopt and enforce flood plain regulations that require future development be elevated above the 100-year flood elevation.

38. Structural measures evaluated included a pumping plant at the Steele Bayou structure, a levee system along the Big Sunflower River, and ring levees with pumping plants to protect built-up residential areas.

39. Combinations of easements (nonstructural) and pumping plants (structural) were also evaluated. Easements included flowage easements for water management and conservation easements to reforest agricultural lands, compensate owners (prohibits intensification), and preserve forested lands.

40. All references to elevations relate to the water elevation at the Steele Bayou structure. Acreages associated with the elevations reflect the number of acres potentially flooded with that water elevation at the Steele Bayou structure. Actual water elevations of potentially flooded lands would be equal to or greater than the water elevation at the Steele Bayou structure.

41. Plan development and screening was an interactive process producing three arrays of alternatives prior to the final array.

INITIAL ARRAY OF ALTERNATIVES

42. The initial array of alternatives was developed to determine whether a Steele Bayou pumping plant was still economically justified. Five pump sizes (10,500, 14,000, 17,500, 21,000 and 24,500 cfs) with a year-round pumping elevation of 80 feet, NGVD, were evaluated. A

Sunflower River levee alternative in lieu of the pump and local protection (ring levees with pumps to protect built-up residential areas) were also evaluated. All pump capacities and the Sunflower River levee alternative were economically feasible, with the 14,000-cfs pump with diesel engines providing the greatest excess benefits over costs (Main Report, Tables 5 and 6). Local protection measures were not economically justified and were eliminated from further consideration.

SECOND ARRAY OF ALTERNATIVES

43. A second array of alternatives resulted from integrating information from the three public involvement workshops with the first array (Main Report, Table 7). Nine nonstructural plans, 6 structural plans, and 13 plans combining nonstructural and structural measures were considered.

44. The nonstructural plans included flowage easements for water management and conservation easements on agricultural lands and forested lands. Flowage easements were evaluated for lands below 80 and 85 feet, NGVD. The flowage easement would be used for water management during the winter waterfowl season. The conservation easement on agricultural lands would allow reforestation of agricultural lands or compensate landowners for continued flooding of their agricultural lands (land use retained). The conservation easement on forested lands would preserve existing forested lands. Conservations easements were evaluated for lands below 85, 90, and 100.3 feet, NGVD.

45. The following assumptions were used to formulate the nonstructural alternatives:

a. Conservation easement with land use retained or reforestation.

(1) Easements taken on cleared land only.

(2) No public access.

(3) Normal silvicultural practices would be allowed.

(4) Future flood damage reduction forgone.

(5) Government has no right to induce flooding.

(6) All encumbrances would be perpetual.

(7) Structures would not be relocated.

(8) All reforested lands would be preserved with restrictions preventing conversion to more intensive use.

(9) Reforestation would be a 100 percent Federal cost.

(10) Operation of Steele Bayou and Little Sunflower structures would continue under current operational guidelines.

b. Conservation easement on existing forested lands.

(1) Easements taken on forested lands only.

(2) No public access.

(3) Normal silvicultural practices would be allowed.

(4) Future flood damage reduction forgone.

(5) Government has no right to induce flooding.

(6) All encumbrances would be perpetual.

(7) Structures would not be relocated.

(8) All forested lands would be preserved with restrictions preventing conversion to more intensive use.

(9) Operation of Steele Bayou and Little Sunflower structures would continue under current operational guidelines.

c. Flowage easements.

(1) Easements taken on cleared and forested lands only.

(2) Residential structures would be relocated.

(3) All encumbrances would be perpetual.

(4) Existing land use would not be allowed to intensify beyond agricultural on open lands.

(5) Operation of Steele Bayou and Little Sunflower structures would be modified to manage water during the period 1 December to 1 March using internal and external sources.

46. The structural plans included the five Steele Bayou pumping plant capacities and the Sunflower River levees. Pumping for all pump capacities was initiated at 80 feet, NGVD, from 1 March to 30 November and 85 feet, NGVD, from 1 December to 28 February (winter waterfowl season).

47. The plans with nonstructural and structural measures included various combinations of the 14,000-cfs pump, conservation easements (land use retained, reforestation and preservation of forested lands) and flowage easements. Conservations easements were evaluated for lands below 85 and 90 feet, NGVD. Flowage easements were evaluated for lands below 80 and 85 feet, NGVD. The pump initiation elevations were 85 and 90 feet, NGVD. The pump would provide structural flood damage reduction above the pumping elevation and conservation easements would provide compensation, nonstructural flood damage reduction, or preservation below the pumping elevation.

48. The nonstructural plans ranged from $210 to $280 million. The structural plans ranged from $104 to $190 million. The plans with combinations of nonstructural and structural measures ranged from $151 to $224 million.

49. Of the 28 alternatives, two nonstructural (Plans 1 and 7), 12 combination, and 3 structural (Plans 24, 25 and 28) plans were selected at the 7 August 1997 briefing for more detailed analysis. The Board of Mississippi Levee Commissioners requested that a 17,500-cfs pump also be evaluated in combination with nonstructural measures. Floodproofing was added as a project measure to all plans.

THIRD ARRAY OF ALTERNATIVES

50. The third array included 2 nonstructural plans, 12 combination plans with a 14,000-cfs pump, 12 combination plans with a 17,500-cfs pump, and 4 structural plans (Main Report, Table 8). Neither of the nonstructural plans was economically justified. Five combination plans

were justified: three with a 14,000-cfs pump and two with a 17,500-cfs pump. Two structural plans were economically feasible: 14,000- and 17,500-cfs pumps.

51. Flowage easements for water management were eliminated from further consideration. There is not sufficient flow during the winter waterfowl season to consistently achieve a stage elevation between 80 and 85 feet, NGVD. Although there is sufficient flow to achieve a stage elevation of 80 feet, NGVD, the measure is not cost effective.

FINAL ARRAY

52. Project measures carried into the final array included:

a. 14,000-cfs pumping plant.

b. Conservation easements with reforestation below the pumping elevation.

c. Conservation easements to preserve forest land below the pumping elevation was retained on Plan 7 at the request of the U.S. Fish and Wildlife Service (FWS).

53. Two additional plans with different pumping elevations which relate to flood frequency were added to the final array based on further discussions with the FWS. The pumping elevations are 87 feet, NGVD (1-year frequency), and 88.5 feet, NGVD (elevation of jurisdictional wetlands based on backwater hydrology). Three operational measures were also included as features to selected plans:

a. Modify the Steele Bayou structure to maintain the water elevation between 70 and 73 feet, NGVD, during low-water periods.

b. Reintroduce Mississippi River flows up to a maximum elevation of 87 feet, NGVD. Pumping elevation of 85 feet, NGVD, from 1 December to 1 March.

54. A report entitled "An Approach for Evaluating Nonstructural Actions with Application to the Yazoo River (MS) Backwater Area" was prepared for the Environmental Protection Agency (EPA), Region 4, by Dr. Leonard Shabman and Ms. Laura Zepp of Virginia Tech. This report was presented and briefed to the Corps on February 11, 2000, by Dr. Shabman. According to the report, there is no formal protocol for evaluating nonstructural measures in this watershed or elsewhere in the Nation comparable to that currently used for/to evaluate structural flood control benefits. In response, Virginia Tech received grant assistance from EPA to:

a. Adopt existing economic analysis protocols for evaluating nonstructural alternatives.

b. Demonstrate the analytical protocol with an evaluation of nonstructural actions for the Yazoo River backwater.

c. Describe an implementation plan that would provide incentives for landowners' adoption of nonstructural actions.

d. Review Corps preliminary estimates of agricultural benefits for a pump.

55. Due to the lateness of the report, the Corps had already formulated the final array of alternatives. The Corps reviewed the report as it related to the Corps planning objectives and whether it adhered to current policies and guidance. The Corps also evaluated whether the report recommendations warranted further review as a reasonable alternative. Several of the Shabman objectives were similar to the Corps objectives. The primary difference was that the Shabman recommendations only affect a portion of those lands and property below the 2-year flood event while the Corps plans carried into the final array provided benefits to those lands and properties up to the 100-year event.

56. In summary, the report identified 3 findings and 12 implications and these are discussed in more detail in Appendix 17.

57. Based on the Corps understanding of the Shabman report, the recommended plan was a nonstructural plan that included voluntary reforesting of approximately 70 percent of the 2-year flood event (88,000 acres), an income assurance program for farms outside the 2-year flood plain, and relocation or the utilization of local flood protection measures for the limited number of structures. This plan was not economically justified without counting benefits from carbon sequestration and nutrient load reduction. These benefit categories cannot be used by the Corps because they have not been determined to be quantifiable and valid. The Principles and Guidelines do not recognize these benefit categories. To be used, economic markets for these two categories must be found to exist and be predictable. Also, these benefit categories must be extended to all Federal water resource projects where reforestation is combined with a nonstructural approach. In addition to these obstacles, it would appear that these benefit categories have been overstated based on recent information received by the Vicksburg District (K. Pennington, 1999, "Relationship Between Surface Water Sediment Concentration, Total Phosphorus, and Total Kjeldahl Nitrogen in Mississippi Delta Streams"; Proceedings of the 29th Mississippi Water Resources Conference; and a recent article in the magazine, "Soybean Digest"). In addition, the report appears to have not accounted for all the costs involved with this approach. The cost of acquiring the entire 88,000 acres as proposed by Dr. Shabman was not quantified, but only accounted for that portion above those lands projected to be enrolled in Wetland Reserve Program and Conservation Reserve Program (approximately 40,000 acres) nor did it account for the administrative cost to acquire these lands, reforest, provide the income assurance program to those lands above the 2-year flood plain, or to relocate any structures.

58. Due to the above-listed reasons and because this plan does not meet the overall objectives of the study, it was found to be an unreasonable alternative and was dropped from further consideration.

59. The no-action, one nonstructural, one structural, and four combination nonstructural and structural plans are included in the final array of alternatives. A comparison of the number and types of alternatives considered in each array is presented in Table SEIS-3.

TABLE SEIS-3
COMPARISON OF ALTERNATIVE TYPES BY ARRAY

Alternative Array	Nonstructural	Structural	Nonstructural/ Structural
First	0	5	0
Second	9	7	12
Third	2	4	24
Final	1	1	4

No Action

60. Plan 1.

a. This is the no-action alternative. This action would not eliminate potential flood damages. Homes and businesses would continue to be affected by flooding, causing a reduction in the standard of living. Governments would continue to pay for flood-fighting efforts, repair of urban and rural roads, bridges, and other infrastructure.

b. The environmental resource value under the no-action alternative depends on the future projection of land use and activities, primarily the acres restored to bottom-land hardwoods through the Wetland Reserve and Conservation Reserve Programs. A no net change in land use and activities would result in the retention of current environmental function and value over the 50-year project life. The FWS, based on past trends of restoration, projects that an additional 43,432 acres of bottom-land hardwood restoration would occur (Appendix 2). This projection would result in a net increase in environmental value over the 50-year project life without the project.

Nonstructural

61. Plan 2. This plan contains nonstructural and operational measures which influence land use pattern and activities. There is no pump feature in Plan 2. To be consistent with plans that

include a pump (i.e., some level of benefit across the study area), the nonstructural easements would provide flood damage reduction through reforestation or some degree of compensation across the entire study area. Reforestation would occur up to the 2-year flood plain (elevation 91 feet) because this is considered to be the ecologically significant area. Compensation would be provided above elevation 91 feet. Measures include:

a. Nonstructural. Acquisition and reforestation of 107,000 acres of agricultural lands below 91 feet, NGVD, through conservation easements. Easements would be perpetual and from willing sellers only.

b. Nonstructural. Acquisition of 237,000 acres of agricultural lands between 91 and 100.3 feet, NGVD, through conservation easements. No agricultural intensification or other development would be allowed under the easement. Easements would be perpetual and from willing sellers only.

c. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods.

Structural

62. Plan 3. This plan uses only structural measures to address flood damage reduction. It also includes an operational measure to address an environmental opportunity. This plan is the National Economic Development plan (provides the greatest excess benefits over costs). Measures include:

a. Structural. A 14,000-cfs pump with a pumping elevation of 80 feet, NGVD, between 1 March and 31 October.

b. Operational. Pumping elevation of 85 feet, NGVD, between 1 November and 28 February. This would allow more water during the winter waterfowl season.

c. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods.

Combination Nonstructural and Structural Plans

63. These plans include nonstructural and structural flood damage reduction measures. They also include operational measures to address environmental opportunities.

64. Plan 4. Measures include:

a. Nonstructural. Acquisition and reforestation of 40,600 acres of agricultural lands below 85 feet, NGVD, through conservation easements. Easements would be perpetual and from willing sellers only.

b. Structural. A 14,000-cfs pump with a year-round pumping elevation of 85 feet, NGVD.

c. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods.

65. Plan 5. Measures include:

a. Nonstructural. Acquisition and reforestation of 62,500 acres of agricultural lands below 87 feet, NGVD (1-year frequency annual flood event), through conservation easements. Easements would be perpetual and from willing sellers only.

b. Structural. A 14,000-cfs pump with a year-round pumping elevation of 87 feet, NGVD.

c. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods.

66. Plan 6. Measures include:

a. Nonstructural. Acquisition and reforestation of 77,300 acres of agricultural lands below 88.5 feet, NGVD, through conservation easements. Easements would be perpetual and from willing sellers only.

b. Structural. A 14,000-cfs pump with a year-round pumping elevation of 88.5 feet, NGVD.

c. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods.

d. Operational. Reintroduce flows from the Mississippi River up to a maximum elevation of 87 feet, NGVD (1-year frequency annual flood event).

67. Plan 7. Measures include:

a. Nonstructural. Acquisition and reforestation of 107,000 acres of agricultural lands below 91 feet, NGVD (2-year flood plain), through conservation easements. Easements would be perpetual and from willing sellers only.

b. Nonstructural. Preservation of 91,600 acres of forested lands below 91 feet, NGVD, through conservation easements. Easements would be perpetual and from willing sellers only.

c. Structural. A 14,000-cfs pump with a year-round pumping elevation of 91 feet, NGVD.

d. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods.

e. Operational. Reintroduce flows from the Mississippi River up to a maximum elevation of 87 feet, NGVD (1-year flood plain).

68. A summary comparison of the final array features is provided in Table SEIS-4.

PLAN SELECTION

69. The no-action alternative (Plan 1) was not considered viable because it does not achieve a balanced solution to the flood control needs and environmental opportunities in the study area. Flood damages to residences, agricultural lands, and infrastructure would continue, impacting the city and county governments and the social well-being of local residents, and the opportunity to achieve significant environmental benefits would be forgone. Plans 3 through 6 are economically justified (Table SEIS-5). Plans 2 and 7 were not economically justified.

TABLE SEIS-4
SUMMARY COMPARISON OF FINAL ARRAY FEATURES

Alternative	Measure		
	Nonstructural	Structural	Operational
Plan 1	Not applicable	Not applicable	Not applicable
Plan 2	107,000 acres of agricultural lands reforested below 91 feet; 237,000 acres of agricultural lands; no intensification or development above 91 feet	Not applicable	Maintain water elevations between 70 and 73 feet during low-water periods.
Plan 3	Not applicable	14,000-cfs pump, 80 feet pumping elevation	85 feet pumping elevation during waterfowl season; Maintain water elevations between 70 and 73 feet during low-water periods
Plan 4	40,600 acres of agricultural lands reforested below 85 feet	14,000-Cfs pump, 85 feet pumping elevation	Maintain water elevations between 70 and 73 feet during low-water periods
Plan 5	62,500 acres of agricultural lands reforested below 87 feet	14,000-cfs pump, 87 feet pumping elevation	Maintain water elevations between 70 and 73 feet during low-water periods
Plan 6	77,300 acres of agricultural lands reforested below 88.5 feet	14,000-cfs pump, 88.5 feet pumping elevation	Maintain water elevations between 70 and 73 feet during low-water periods; reintroduce Mississippi River water to 87 feet
Plan 7	107,000 acres of agricultural lands reforested below 91 feet	14,000-cfs pump, 91 feet pumping elevation	Maintain water elevations between 70 and 73 feet during low-water periods; reintroduce Mississippi River water to 87 feet

TABLE SEIS-5
SUMMARY, ECONOMIC ANALYSIS
FIRST COSTS, ANNUAL COSTS, ANNUAL BENEFITS,
EXCESS BENEFITS OVER COST, AND BENEFIT-COST RATIO
YAZOO BACKWATER AREA REFORMULATION
(6-5/8 Percent Federal Discount Rate)

Item	Alternative Plans (Final Array)					
	2	3	4	5	6	7
First Cost b/c/ ($000)	291,001	153,710	154,732	181,595	196,274	274,654
Annual Cost b/c/d/ ($000)	22,005	13,302	12,920	14,881	15,950	21,811
Annual Benefits d/ ($000)						
All Benefit Categories	2,410	19,601	18,222	17,944	16,620	14,630
Benefits with Employment Benefits Excluded	1,569	19,163	17,762	17,438	16,081	13,851
Excess Benefits Over Cost ($000)						
All Benefit Categories	(19,595)	6,299	5,302	3,063	670	(7,181)
Benefits with Employment Benefits Excluded	(20,436)	5,861	4,842	2,557	131	(7,960)
Benefit-Cost Ratio						
All Benefit Categories	.11	1.47	1.41	1.21	1.04	.67
Benefits With Employment Benefits Excluded	.07	1.44	1.37	1.17	1.01	.64

a/ February 2000 price levels.
b/ Includes costs for mitigation for Plan 3; Plans 2 and 4-7 include conservation easement and reforestation costs.
c/ Annualized using 50-year project life.

70. Plan 3 does not balance the flood control needs and environmental opportunities in the study area. It provides substantial flood control benefits with a no-net-loss of environmental values. Plans 4, 5, 6, and 7 best address the combined flood control needs and environmental opportunities in the study area. They provide a balanced nonstructural-structural approach to flood damage reduction and provide substantial flood control and environmental benefits.

71. Plan 7 would reforest 107,000 acres within the 2-year flood plain. Although the 2-year flood plain is the most ecologically significant portion of the study area, this plan was not

economically justified. Plan 6 would reforest 77,300 acres below elevation 88.5 (elevation for jurisdictional wetland backwater hydrology). This plan would be more desirable than reforesting 62,500 acres in the 1-year flood plain (Plan 5), but is marginally justified. Plan 4 would reforest 40,600 acres and would produce greater excess benefits than Plan 5, but would not provide as many ecological benefits. Plan 5 more completely addresses the environmental opportunities and concerns than Plan 4 for the following reasons:

a. Plan 5 has no effect on the size of the 1-year flood plain. It is the same size with and without the project. Plan 4 reduces the 1-year flood plain elevation approximately 2 feet, which results in the loss of 41,823 acres from the 1-year flood plain.

b. Plan 5 would reforest 58 percent of the agricultural lands within the ecologically sensitive 2-year flood plain. Whereas, Plan 4 would reforest only 38 percent, less than half of the available agricultural lands.

c. Increasing the pumping elevation from 85 to 87 feet increases the probability of successful fish egg incubation. The fish spawning model uses an 8-day duration as an average incubation period. The range is from 1 to 14 days. Increasing the size of the flood plain would benefit those fishes that are at the upper end of the incubation range.

d. The shorter duration and higher frequency of inundation of the 85-foot flood plain versus the 1-year flood plain would result is greater variability and instability of inundation of forests with Plan 4. Not reforesting lands between 85 and 87 feet could result in significantly reduced habitat value.

e. A greater area of inundation results in better connectivity between aquatic flood plain habitat types, particularly between agricultural lands and bottom-land hardwoods. This is especially important because the predation rate on larval fish is higher in agricultural lands. Better connectivity allows larval fish to disperse into the structural cover of bottom-land hardwoods.

f. Particulate organic matter, mainly leaf detritus from the flood plain forests, is the basis of the food chain in heterotrophic systems such as the Yazoo River and Lower Mississippi River. Reforestation of the hydrologically unchanged 1-year flood plain would result in a significant increase in export of particulate organic matter to the aquatic system, which would increase benthic invertebrate and zooplankton production.

g. The fish-carrying capacity of a river system is dependent in part on the habitat quantity and quality during annual low flow conditions. The increased amount of low flow aquatic habitat provided with Plan 5 could significantly increase standing stock and production for many fish species. Reforestation of the 1-year flood plain (versus the 85-foot elevation flood plain for Plan 4) would provide a larger area of reforestation, and therefore better ensure the supply of organic matter and fish food organisms to young-of-the-year fish necessary to support increased standing stock from the increased low-flow habitat.

h. Water quality improvement would be greater with reforestation of the 1-year flood plain. A larger area would be removed from agricultural production, and therefore, greater decreases in suspended sediments and nutrients would occur.

i. Reforestation of the 1-year flood plain (as opposed to the 85-foot flood plain) will result in additional larger contiguous tracts of wooded habitat, which would greatly increase habitat value for the black bear and other bottom-land hardwood bird and mammal species, including Neotropical birds.

72. Plan 5 is the most balanced, implementable approach, and meets the economic and environmental needs of the basin. Reforestation of 62,500 acres within the 1-year flood plain as a nonstructural flood damage reduction is a multibenefit approach to addressing the needs and opportunities in this ecologically significant area. This plan would reforest 58 percent of these ecologically significant lands within the 2-year flood plain. Clear recognition of the ecologically significance of this area is provided through concerted restoration efforts by Federal and state agencies and private organizations. These include:

a. Mississippi Alluvial Valley Migratory Bird Conservation Initiative designated the Yazoo Backwater Area as a high priority migratory bird conservation zone.

b. North American Waterfowl Management Plan named the Lower Mississippi Valley as one of seven priority conservation areas in the United States.

c. Supports the Lower Mississippi Valley Joint Venture habitat restoration objectives for species targeted by the North American Waterfowl management plan, Partners in Flight, and the U.S. Shorebird Conservation Plan.

d. Supports habitat restoration goals set by the Lower Mississippi River Conservation Committee.

e. Supports the Black Bear Conservation Committee's goal of reversing those factors (including clearing of bottom-land hardwoods) that have brought about the decline of the Louisiana black bear (listed as threatened under the Endangered Species Act). The Yazoo Backwater area has been targeted for the establishment of a subpopulation of the Louisiana black bear.

f. Supports the efforts to recover the Federally listed endangered plant pondberry, through restoration of potential habitat.

g. Supports the Clean Water Action Plan for restoration of wetlands through reforestation of agricultural lands within hydrologically unchanged 1-year flood plain.

For additional discussions and details, see SCREENING OF ALTERNATIVE PLANS and PLAN SELECTION sections in the Main Report.

RECOMMENDED PLAN

73. The recommended plan is Plan 5. Nonstructural flood damage reduction (reforestation) would be provided below 87 feet, NGVD, and structural flood damage reduction (pump) would be provided above 87 feet, NGVD. Operation of the Steele Bayou structure would be modified to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods. Current operation is to maintain water elevations between 68.5 and 70 feet, NGVD. This change would allow greater water depths during low-flow periods and would improve water quality conditions for the aquatic resource. There are conversion (clearing), hydrologic (pump operation), and reforestation effects associated with this plan. Thirty-eight acres of bottom-land hardwoods and 110.5 acres of open land will be converted to project features at the pump site. Plan features include:

a. Nonstructural. Acquisition and reforestation of 62,500 acres of agricultural lands below 87 feet, NGVD (1-year flood plain), through conservation easements. Easements would be perpetual and from willing sellers only.

b. Structural. A 14,000-cfs pump with a year-round pumping elevation of 87 feet, NGVD.

c. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

74. The pumping plant would be operated according to a pump operation manual. This operation plan would address several factors. One factor would be that the diesel-driven pumps could not be instantaneously turned on all at the same time nor would all the pumps be utilized every time stages were predicted to exceed 87.0 feet, NGVD. Other factors that would have to be accounted for would be the forecast of inflows due to Mississippi River conditions, interior

conditions (stages and ground conditions) and forecasted flood and weather conditions. In order to achieve the level of protection projected by the recommended plan, it is anticipated that some of the pumps would have to be turned on prior to stages reaching 87.0 feet, NGVD.

75. Agricultural benefits of the recommended plan were updated to include 1999 crop budgets and 1999 current normalized (Guideline II) prices. Table SEIS-6 presents first costs, annual costs, benefits, excess benefits, and benefit-cost ratios for the recommended plan at the 6-5/8 percent discount rate. Total benefits of the recommended plan are estimated to be $21.5 million at the current discount rate of 6-5/8 percent, excluding employment benefits. Annual costs are estimated to be $14.9 million. Net benefits excluding employment benefits are estimated at $6.6 million. Total annual nonstructural benefits for the recommended plan are estimated to be $3.9 million based on this analysis.

COMPARATIVE IMPACTS OF ALTERNATIVES

76. Comparison of the effects of each alternative is presented in Table SEIS-7.

ENVIRONMENTAL DESIGN AND MEASURES TO MINIMIZE IMPACTS

77. Environmental design and measures to avoid and minimize adverse effects include a higher pumping elevation, nonstructural flood damage reduction, and maintaining higher water levels during the low-water period.

Higher Pumping Elevation

78. The initiation of pumping is 7 feet above the elevation at which flood damages begin to occur (80 feet). This measure avoids adverse effects to terrestrial, wetland, waterfowl and aquatic resources below 87 feet, NGVD.

TABLE SEIS-6
SUMMARY ECONOMIC ANALYSIS
YAZOO BACKWATER RECOMMENDED PLAN
(6-5/8 Percent Discount Rate)

Item	Plan 5
Benefits ($000)	
Structural	
Agricultural Crop	11,639
Agricultural Noncrop	2,241
Structures	2,256
Road and Bridge	828
Urban Streets	83
Emergency Costs	158
FIA	30
Catfish	365
Nonstructural	
Agricultural Crop a/	2,960
Timber/Hunting Leases	936
Subtotal Nonstructural	3,896
Employment	506
Total Annual Benefits ($000)	
(Excluding Employment)	21,496
(Including Employment)	22,002
First Cost ($000)	181,595
Interest During Construction ($000)	17,305
Gross Investment ($000)	198,900
Annual Costs ($000)	
Amortization	13,732
O&M Project	812
O&M Energy	183
Pump Replacement	154
Total	14,881
Excess Benefits ($000)	
(Excluding Employment)	6,615
(Including Employment)	7,121
Benefit-Cost Ratio	
(Excluding Employment)	1.44
(Including Employment)	1.48

a/ Benefits consist of insurable losses.

TABLE SEIS-7
COMPARATIVE IMPACTS OF ALTERNATIVES a/
YAZOO BACKWATER PROJECT
(RECOMMENDED PLAN IS PLAN 5)

Alternative	Terrestrial Resources b/	Aquatic Resources c/	Wetland Resources d/	Waterfowl Habitat e/	Water Quality	Endangered Species
No Action Plan 1	Existing conditions will continue. 233,869 acres of bottom-land hardwood habitat.	Existing conditions will continue. 72,316 acres of 2-year average seasonal flooded acres.	Existing conditions will continue. 35,134 average daily bottom-land hardwood acres within the 2-year flood frequency and 13,398 average daily farmed wetland acres within the 2-year flood frequency.	Existing conditions will continue. 9,138 acres of average seasonal habitat available.	Existing conditions will continue. No direct impacts. Degraded water quality would continue.	Not applicable.
Plan 2	28.4 percent increase in terrestrial habitat. Net gain of 175,542 AAHU's. Reforestation of 107,000 acres of frequently flooded agricultural land.	40 percent increase in flood plain spawning habitat or 80,072 HU's. Reforestation of 107,000 acres of frequently flooded land.	41.5 percent increase of forested wetlands functional value or 77,919 FCU's. Reforestation of 107,000 acres of frequently flooded agricultural land.	39.8 percent reduction in waterfowl foraging habitat value or 824,505 DUD's. Reforestation of 107,000 acres of frequently flooded agricultural land.	Conditions should improve with the reforestation of 107,000 acres of agricultural land.	Reforestation of 107,000 acres will provide additional habitat for the endangered pondberry plant (*Lindera melissifolia)* and threatened Louisiana black bear (*Ursus americanus luteolus*).
Plan 3	1.1 percent reduction in terrestrial resource value or 6,680 AAHU's. 38 acres of bottom-land hardwoods converted or a loss of 108 AAHU's. Hydrologic loss of 6,572 AAHU's on bottom-land hardwoods. Requires compensatory mitigation of 38 acres of frequently flooded agricultural lands.	31.8 percent reduction in flood plain spawning habitat value or 63,886 HU's. 38 acres of bottom-land hardwoods converted or a loss of 142 HU's. Hydrologic loss of 63,744 HU's on various habitats. Requires compensatory mitigation of 27,435 acres of frequently flooded agricultural land.	24.3 percent loss of wetland functional value or 53,251 FCU's. 38 acres of bottom-land hardwoods and 110.5 acres of farmed wetlands converted or a loss of 463 FCU's. Hydrologic loss of 52,788 FCU's. Requires compensatory mitigation of 23,001 acres of frequently flooded agricultural lands.	9.2 percent loss of waterfowl foraging habitat value or 191,100 DUD's. Direct loss of 38 acres of bottom-land hardwoods or 2,166 DUD's. Hydrologic loss of 188,934 DUD's of waterfowl foraging habitat value. Requires compensatory mitigation of 1,613 acres of frequently flooded agricultural lands.	Construction of structural features will cause a short-term increase in turbidity. Reforestation of 27,435 acres of agricultural land will improve water quality over time.	An on-ground survey and biological assessment for *Lindera melissifolia* and *Ursus americanus luteolus* were completed. No colonies of pondberry were found in rights-of-way and no signs of Louisiana black bear were found. Biological assessment concludes that the project is not likely to adversely affect either species. No indirect or hydrologic impacts on either species. Reforestation of 27,435 acres will provide additional habitat.
Plan 4	12.1 percent increase in terrestrial resource value or 74,533 AAHU's. 38 acres of bottom-land hardwoods converted or a loss of 108 AAHU's. Hydrologic loss of 3,832 AAHU's on bottom-land hardwoods. Reforestation of 40,600 acres of bottom-land hardwoods or gain of 78,473 AAHU's.	5.2 percent increase in flood plain spawning habitat value or 10,466 HU's. 38 acres of bottom-land hardwoods converted or a loss of 142 HU's. Hydrologic loss of 49,151 HU's on various habitats. Reforestation of 40,600 acres of bottom-land hardwoods or gain of 59,759 HU's.	10.6 percent gain of wetland functional value or 23,295 FCU's. 38 acres of bottom-land hardwoods and 110.5 acres of farmed wetlands converted or a loss of 463 FCU's. Hydrologic loss of 39,469 FCU's. Reforestation of 40,600 acres of bottom-land hardwoods or gain of 63,227 FCU's.	45.2 percent loss of waterfowl foraging habitat value or 936,609 DUD's. Direct loss of 38 acres of bottom-land hardwoods or 2,166 DUD's. Hydrologic loss of 184,086 DUD's of waterfowl foraging habitat value; reforestation of 40,600 acres of bottom-land hardwoods or loss of 750,357 DUD's.	Construction of structural features will cause a short-term increase in turbidity; reforestation of 40,600 acres of agricultural land will improve water quality over time.	Same as Alternative 3 except reforestation of 40,600 acres will provide additional habitat.

TABLE SEIS-7 (Cont)

Alternative	Terrestrial Resources b/	Aquatic Resources c/	Wetland Resources d/	Waterfowl Habitat e/	Water Quality	Endangered Species
Plan 5	17.4 percent increase in terrestrial habitat value or 107,674 AAHU's. 38 acres of bottom-land hardwoods converted or a loss of 108 AAHU's. Hydrologic loss of 2,896 AAHU's on bottom-land hardwoods. Reforestation of 62,500 acres of bottom-land hardwoods or a gain of 110,678 AAHU's.	18.7 percent increase in flood plain spawning habitat values or 37,428 HU's. 38 acres of bottom-land hardwoods converted or a loss of 142 HU's. Hydrologic loss of 29,919 HU's on various habitats. Reforestation of 62,500 acres of bottom-land hardwoods or gain of 67,489 HU's.	23.5 percent gain of wetland functional value or 51,520 FCU's. 38 acres of bottom-land hardwoods and 110.5 acres of farmed wetlands converted or a loss of 463 FCU's. Hydrologic loss of 18,579 FCU's. Reforestation of 62,500 acres of bottom-land hardwoods or gain of 70,562 FCU's.	42.1 percent loss of waterfowl foraging habitat value or 873,432 DUD's. Direct loss of 38 acres of bottom-land hardwoods or 2,166 DUD's; hydrologic loss of 80,438 DUD's of waterfowl foraging habitat; reforestation of 62,500 acres of bottom-land hardwoods or loss of 790,828 DUD's.	Construction of structural features will cause a short-term increase in turbidity; reforestation of 62,500 acres of agricultural land will improve water quality over time.	Same as Alternative 3, except reforestation of 62,500 acres will provide additional habitat.
Plan 6	21.9 percent increase in terrestrial habitat value or 134,987 AAHU's. 38 acres of bottom-land hardwoods converted or a loss of 108 AAHU's. Hydrologic gain of 1183 AAHU's on bottom-land hardwoods. Reforestation of 77,300 acres of bottom-land hardwoods or a gain of 133,912 AAHU's.	30.9 percent increase in flood plain spawning habitat value or 61,754 HU's. 38 acres of bottom-land hardwoods converted or a loss of 142 HU's. Hydrologic loss of 12,659 HU's on various habitat. Reforestation of 77,300 acres of bottom-land hardwoods or gain of 74,555 HU's.	47.9 percent gain of wetland functional value or 104,927 FCU's. 38 acres of bottom-land hardwoods and 110.5 acres of farmed wetlands converted or a loss of 463 FCU's. Hydrologic gain of 22,072 FCU's. Reforestation of 77,300 acres of bottom-land hardwoods or gain of 83,318 FCU's.	30.1 percent loss of waterfowl foraging habitat value or 634,017 DUD's. Direct loss of 38 acres of bottom-land hardwoods or 2,166 DUD's; hydrologic gain of 326,326 DUD's of waterfowl foraging habitat value; reforestation of 77,300 acres of bottom-land hardwoods or loss of 958,177 DUD's.	Construction of structural features will cause a short-term increase in turbidity; reforestation of 77,300 acres of agricultural land will improve water quality over time.	Same as Alternative 3, except reforestation of 77,300 acres will provide additional habitat.
Plan 7	29.4 percent increase in terrestrial resource value or 181,328 AAHU's. 38 acres of bottom-land hardwoods converted or a loss of 108 AAHU's. Hydrologic gain of 3,721 AAHU's on bottom-land hardwoods. Reforestation of 107,000 acres of bottom-land hardwoods or a gain of 177,715 AAHU's.	41.9 percent increase in flood plain spawning habitat value or 83,860 HU's. 38 acres of bottom-land hardwoods converted or a loss of 142 HU's; hydrologic gain of 2,802 HU on various habitats. Reforestation of 107,000 acres of bottom-land hardwoods or gain of 81,200 HU's.	56.0 percent gain in wetland functional value or 122,723 FCU's. 38 acres of bottom-land hardwoods and 110.5 acres of farmed wetlands converted or a loss of 463 FCU's. Hydrologic gain of 30,824 FCU's. Reforestation of 107,000 acres of bottom-land hardwoods or gain of 923,621 FCU's.	29.6 percent loss of waterfowl foraging habitat value or 612,924 DUD's. Direct loss of 38 acres of bottom-land hardwood or 2,166 DUD's. Hydrologic gain of 362,462 DUD's of waterfowl foraging habitat. Reforestation of 107,000 acres of bottom-land hardwoods or loss of 973,220 DUD's.	Construction of structural features will cause a short-term increase in turbidity, reforestation of 107,000 acres of agricultural land will improve water quality over time.	Same as Alternative 3, except reforestation of 107,000 acres will provide additional habitat.

NOTE: For detailed information on aquatic resources, waterfowl resources, terrestrial resources, wetlands resources, water quality, ground water, and endangered species, see Appendixes 9-15.

a/ Terrestrial, aquatic, wetland, and waterfowl impacts include losses from the completed and reformulated portions of the Yazoo Backwater area. Water quality, ground water, and endangered species apply only to the reformulated portion of the Yazoo Backwater project area.

b/ AAHU = average annual habitat units.

c/ HU = units.

d/ FCU = functional capacity units.

e/ DUD = duck-use-days. Although reforestation results in a loss of waterfowl foraging habitat by all plans, there are other important waterfowl habitat requirements that are met with reforestation (loafing, pair bonding, shelter, etc.) and that are notably absent in agricultural fields. According to the U.S. Fish and Wildlife Service, the overall benefit that results from reforestation far exceeds losses of foraging habitat.

Nonstructural Flood Damage Reduction

79. The method of nonstructural flood damage reduction (reforestation) provides positive environmental benefits. The recommended plan would reforest 62,500 acres of agricultural land below 87 feet, NGVD, as a nonstructural flood damage reduction measure. This provides a net gain in terrestrial, wetland, waterfowl, and aquatic resource values to the study area.

Modification of the Operation of the
Steele Bayou Structure

80. Operation of the Steele Bayou structure would be modified to maintain water elevations between 70 and 73 feet, NGVD, during low-water periods. Current operation is to maintain water elevations between 68.5 and 70 feet, NGVD. This change would allow greater water depths during low-flow periods and would improve water quality conditions for aquatic resources.

MITIGATION (COMPENSATION) PLAN

81. Compensatory mitigation (normally reforestation of agricultural lands) for unavoidable impacts is determined after avoidance and minimization of impacts are considered.

82. There is no compensatory mitigation required for Plan 2 (nonstructural). Plan 3 (structural) requires 27,435 acres of fee title acquisition and reforestation to offset unavoidable effects. Plans 4 through 7 are combinations of structural and nonstructural measures. Because the structural and nonstructural measures are both necessary to address the flood control and environmental opportunities on combination plans, the need for compensatory mitigation was evaluated after the net effects of the entire plan were determined. Plans 4 through 7 require no compensatory mitigation (Table SEIS-8).

TABLE SEIS-8
COMPENSATORY MITIGATION AND MINIMUM THRESHOLDS FOR
NONSTRUCTURAL REFORESTATION

Alternative	Compensatory Mitigation (Acres)	Minimum Threshold a/ (Acres)
Plan1	None	None
Plan 2	None	None
Plan 3	27,435	27,435
Plan 4	None	21,199
Plan 5	None	12,980
Plan 6	None	5,064
Plan 7	None	194

a/ Number of acres to reforest to achieve a no-net-loss of environmental resource value. Achievement of this threshold would offset the adverse effects due to the construction and operation of the pump.

83. Because reforestation for nonstructural flood damage reduction is from willing sellers, it is possible that not all acres would be acquired and reforested. Therefore, on combination plans, a minimum threshold of reforestation was determined to offset the adverse effects due to the construction and operation of the pump only (Table SEIS-8). If this minimum threshold is not achieved through easement acquisition from willing sellers, then the remaining acreage required to achieve this threshold would be acquired in fee title.

84. Implementation of the recommended plan would not require compensatory mitigation. The net effect of the plan is a gain in wetland, terrestrial, waterfowl, and flood plain aquatic resource values. Although the operation of the pump would cause adverse impacts to environmental resources, the nonstructural component (reforestation of 62,500 acres) provides significant increases in environmental values. A minimum of 12,980 acres would be required to achieve a no-net-loss of environmental resource value on the recommended plan.

PROJECT MAINTENANCE

85. Maintenance of the inlet and outlet channels for the pumping plant would be conducted over the 50-year project life. An estimated 80,000 cubic yards of material would be excavated every 15 years from the channels. Herbicide spraying and/or mechanical methods would be used to control vegetative growth along the banks of the inlet and outlet channels. Major replacement at the pumping plant would occur at year 35 of the project.

86. After the establishment and initial survival monitoring (up to 3 years) of the seedlings on the easement lands, there would be no additional monitoring. Land use on the easement lands would be monitored every 5 years through remote sensing techniques to ensure compliance with the easement requirements.

87. Major maintenance would be the responsibility of the Corps of Engineers, and minor maintenance would be the responsibility of the local sponsor (Board of Mississippi Levee Commissioners). Minor maintenance would involve the spraying and removal of vegetative growth from the inlet and outlet channel.

AFFECTED ENVIRONMENT

GENERAL DESCRIPTION

88. Extending from Memphis, Tennessee, to Vicksburg, Mississippi, the Yazoo Basin covers 13,400 square miles and two physiographic subdivisions. The Delta physiographic subdivision is 6,600 square miles of swamps, natural levees, point bars, and abandoned streams. The study area is approximately 926,000 acres in the lower portion of the Delta known as the Yazoo Area (Plate 4-1). It includes all or portions of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties, Mississippi, and a portion of Madison Parish, Louisiana. The study area was divided into four reaches for planning and environmental analyses (Plate 4-4).

CLIMATE

89. The climate is mild with an average annual temperature of 65 degrees F. The average monthly temperature ranges from 44 degrees F in January to 82 degrees F in July. Annual rainfall averages 51 inches. Normal monthly rainfall varies from 5.81 inches in March to 2.58 inches in October.

HUMAN RESOURCES

90. The economic base study area (Plate 4-2) comprises Sharkey and Issaquena Counties, Mississippi, which are completely or primarily within the hydrological boundaries of the Yazoo Backwater Watershed and are considered to be economically representative of the project area. These counties cover approximately 841 square miles in total land area. Significant population clusters within the two counties are referred to as "built-up" areas. Built-up areas include Valley Park, Eagle Lake, Cary, and Holly Bluff, and portions of Mayersville, Rolling Fork, Anguilla, Belzoni, and Hollandale, Mississippi.

91. Overall, the population of the Yazoo Backwater study area has decreased from 21,550 in 1940 to approximately 8,975 in 1990 or a 58 percent decline. The most significant occurrence was the loss of over 7,250 persons during the 1940 to 1960 period. Sharkey County experienced the majority of the loss, a decline of 8,084 persons from 1940 to 1990. The number of persons per square mile (population density) in the Yazoo Backwater study area has ranged from 25.5 persons per square mile of land area in 1940 to 10.5 persons in 1992 and is estimated to be 10.2 in 2000.

92. Almost the entire project area has excellent transportation access facilities. Access is provided by Federal, state, and local highways, railroads, aircraft, and waterways via the Yazoo River. U.S. Highway 61 bisects the area and provides two-lane, north-south access through Valley Park, Rolling Fork, and Hollandale, Mississippi. Mississippi Highway 12 provides two-lane, east-west, access through Belzoni and Hollandale. U.S. Interstate 20 is located to the south of the project area, and U.S. Interstate 55 is located to the east of the area--both providing access

to points throughout the United States and connections for access to neighboring countries. Two major rail systems located outside the project area provide adequate rail transportation. The Columbus and Greenville Railroad, located to the north of the area, operates 232 miles of rail system from Columbus, Mississippi, to Greenville, Mississippi. The Illinois-Central Railroad, located to the east of the project area, operates 935 miles of rail service from Chicago, Illinois. It provides north-south access from Memphis, Tennessee, through Greenwood to Jackson, Mississippi. The area is accessible by water via the Yazoo River. The navigation channel from Greenwood to Vicksburg is 9 feet deep approximately 46 percent of the time. Terminal port facilities serving the Yazoo Backwater project area are located in Greenwood, Belzoni, and Yazoo City, Mississippi.

93. Most of the industry in the area is agribusiness-oriented. Previously, agriculturally related employment dominated the area; however, activities of nonagricultural industries currently constitute a major portion of the total economy. In 1990, three major industry groups accounted for almost one-half (46 percent) of the total employment in the area. These groups include services (18 percent), government (14 percent), and manufacturing (14 percent). Agricultural employment comprised 34 percent of the total employment in 1990.

94. The number of farms has decreased significantly from 2,036 in 1954 to 234 in 1992, while the average size of farms has increased from 140 to 1,250 acres during the same period. Much of this increase can be attributed to rural and industrial expansion in the area. The value of farm products sold was an estimated $36.9 million in 1954 (expressed in 1982 dollars), increasing to $58.4 million in 1964, then decreasing to $41.2 million in 1969. However, since that point, the value of farm products sold increased steadily, reaching $68.8 million by 1987. This represented an overall increase of 86 percent from 1954 to 1987. Sales from crops represented approximately 92 percent of the total value from agricultural products sold in 1987. This compares to 94 percent in 1982.

LAND USE

95. Land use apportionment and distribution are important in defining the structural and functional characteristics of the environment. The Yazoo Backwater project area (Table SEIS-9) and study area (Table SEIS-10) are a mosaic of agricultural land, bottom-land hardwoods, and swamp, rivers and lakes, and urban areas (Plate 4-34). All economic and environmental analyses were conducted within the study area (100-year flood frequency).

96. Agriculture accounts for 57 percent of the land use in the study area (Table SEIS-10). Soybeans account for 33 percent of the agricultural land use. Approximately 37 percent of land use is in bottom-land hardwood and swamps. Larger tracts support a diversity of flora and fauna, but the remaining bottom-land hardwood acreage is fragmented, diminishing the inherent habitat value.

97. Projecting future land use is very difficult and involves a high degree of uncertainty. The Corps assumed that existing land use conditions would continue over the project life (Tables SEIS-9 and SEIS-10). The Vicksburg District did not project an increase in reforestation because the ceilings for enrollment in Sharkey and Issaquena Counties have been reached. Local citizens have expressed reservations on raising these ceilings due to the negative impact on county tax revenues. Based on local and to-date actions and recent congressional actions, future expansions of these programs is not likely in the opinion of the Vicksburg District. The FWS estimated that 43,432 acres of agricultural lands would be reforested in the study area primarily through the Wetlands Reserve Program over the project life (Appendix 2). Approximately 30,293 acres would be reforested in the 2-year flood frequency event (=91 feet, NGVD). It was assumed that all reforestation in the 2-year flood frequency would occur on soybean lands. Under the FWS future without-project projection, there would be a 20.8 percent increase in bottom-land hardwoods in the study area and a 20.7 percent decrease in soybean lands. Both scenarios are evaluated.

TABLE SEIS-9
EXISTING LAND USE
AND CORPS AND FISH AND WILDLIFE SERVICE (FWS)
FUTURE WITHOUT-PROJECT LAND USE
IN THE YAZOO BACKWATER PROJECT AREA a/

Land Use	Existing Conditions	Corps Future Without-Project	FWS Future Without-Project
Soybeans	299,792	299,792	256,360
Cotton	178,042	178,042	178,042
Rice	59,648	59,648	59,648
Other Agriculture	63,183	63,183	63,183
Bottom-land Hardwood	235,350	235,350	278,782
Swamp	39,355	39,355	39,355
Rivers and Lakes	18,410	18,410	18,410
Ponds	32,121	32,121	32,121
Total	925,901	925,901	925,901

a/ Yazoo Backwater project area includes all lands in the Yazoo Area. Based on 1988 satellite data.

TABLE SEIS-10
EXISTING LAND USE
AND CORPS AND FISH AND WILDLIFE SERVICE (FWS)
FUTURE WITHOUT-PROJECT LAND USE
IN THE YAZOO BACKWATER STUDY AREA a/

Land Use	Existing Conditions	Corps Future Without-Project	FWS Future Without-Project
Soybeans	205,287	205,287	162,864
Cotton	71,939	71,939	71,939
Rice	44,793	44,793	44,793
Other Agriculture	39,031	39,031	39,031
Bottom-land Hardwood	204,218	204,218	246,641
Swamp	29,651	29,651	29,651
Rivers and Lakes	16,174	16,174	16,174
Ponds	18,628	18,628	18,628
Total	629,721	629,721	629,721

a/ Study area includes all lands in the 100-year flood frequency.

98. Approximately 78 percent of study area lands are privately held (Table SEIS-11). Twenty-two percent of lands are in state wildlife management areas, national forests, national wildlife refuges, and Wetland and Conservation Reserve Programs. Eighty-seven percent of cleared and 61 percent of forested lands are privately held.

TABLE SEIS-11
DISTRIBUTION OF PUBLIC AND PRIVATE LAND USE
IN THE STUDY AREA a/

Land Use	Private	Public Interest b/	Total
Agricultural	315,611	45,438	361,049
Forested	143,670	90,199	233,869
Water	32,315	2,488	34,803
Total	491,596	138,125	629,721

a/ Study area includes all lands in the 100-year flood frequency.
b/ Includes wildlife management areas, national forests, national wildlife refuges and wetland and conservation reserve programs.

SIGNIFICANT RESOURCES

99. Significant resources are recognized by institutional, public or technical criteria. Public recognition can include controversy, support or opposition relative to utilization of resources. Technical recognition is based on scientific knowledge or judgment of resource characteristics. The significance may be recognized by more than one criterion. For example, the significance of bottom-land hardwoods is recognized by Public Law 99-662 (requires in-kind mitigation to the extent possible), local communities for the consumptive and nonconsumptive recreational value, and the scientific community for the wetland functional value.

100. Significant natural resource areas include Leroy Percy State Park, Shipland Wildlife Management Area, Panther Swamp National Wildlife Refuge, Yazoo National Wildlife Refuge, Delta National Forest, Lake George Wildlife Management Area, Twin Oaks Wildlife Management Area, and Mahannah Wildlife Management Area. These areas provide recreational, water quality,

esthetic, wildlife, and intrinsic benefits to the human environment. Specific significant resources include prime farmlands, waterfowl, bottom-land hardwoods, wetlands, threatened and endangered species, and cultural resources.

PRIME FARMLANDS

101. Sixty-four percent of the land use is dedicated to agriculture. Pursuant to coordination requirements of the Farmland Protection Policy Act, the Natural Resources Conservation Service has been sent form AD-1006. This form evaluates the potential impacts of the alternatives on prime and unique farmlands.

WATERFOWL RESOURCES

102. The North American Waterfowl Management Plan states, "in all waterfowl management decisions and actions, first priority should be given to perpetuate waterfowl populations and their supporting habitats." Wintering waterfowl populations in the Mississippi River Alluvial Valley and the study area are below long-term averages, the result of breeding and wintering habitat conversion (Appendix 11). Habitat availability, utilization, and suitability are critical components to wintering waterfowl. Recent research showed the winter wetland availability is linked to current and cross-seasoned life-cycle events of mallards and wood ducks and possible other waterfowl using alluvial environments (Appendix 11). The waterfowl analysis conducted for this study was used because it addresses key components of habitat availability and utilization. Accordingly, baseline available waterfowl foraging habitat and carrying capacity were estimated by integrating period-of-record hydrology (1943-1997) and land use (Appendix 11).

103. The index of carrying capacity for waterfowl foraging habitat was expressed in duck-use-days (DUD) per acre. One DUD represents the amount of energy required for one duck for one day. The methodology required (1) current land use, (2) extent, duration, and depth of flooding,

(3) amount of winter food present by land use, (4) energy of food items, (5) deterioration rates of food items, (6) energy requirements of waterfowl, and (7) estimated density of waterfowl. The waterfowl analysis was limited to land use categories with potential foraging value: soybeans, rice, fallow fields and bottom-land hardwoods. See Appendix 11 for detailed discussions.

104. To account for the modified hydrology from the pump operation and water management, acres within the 2-year flood plain were converted to average seasonal daily flooded acres (duck acres). Average duck acres were determined by summing the number of acres flooded less than 18 inches each day between 1 November and 28 February over the period of record (1943 to 1997) and dividing the total by the number of days. Land use percentages in the 2-year flood plain (Table SEIS-12) were applied to the duck areas to determine the average seasonal duck acres for each habitat type (Table SEIS-13). The DUD/acre habitat value ranged from 57 for bottom-land hardwoods to 1,037 for fallow land.

105. The FWS future without-project projection assumed that 30,293 acres within the 2-year flood frequency would be reforested. It was assumed that this would account for all average seasonal daily flooded acres available for reforestation.

106. Baseline seasonal carrying capacity for the study area is approximately 2,074,371 DUD's on 9,138 acres of seasonally flooded foraging habitat available from 1 November to 28 February (Table SEIS-14 and Appendix 11). The Corps future without-project projection is also 2,074,371 DUD's. The FWS future without-project projection is 1,249,866 DUD's, a decrease of 39.8 percent (824,505 DUD's) over the life of the project. This results from removing relatively higher value agricultural lands from production and converting them to bottom-land hardwoods which have a relatively lower foraging value. However, there are other beneficial waterfowl values (loafing, etc.) associated with reforestation (Appendix 11).

TABLE SEIS-12
RELATIVE WATERFOWL FORAGING HABITAT DISTRIBUTION (%)
FOR BASELINE AND CORPS AND FISH AND WILDLIFE SERVICE
FUTURE WITHOUT-PROJECT PROJECTIONS

Land Use	Reach 1		Reach 2		Reach 3		Reach 4	
	Corps a/	FWS	Corps	FWS	Corps	FWS	Corps	FWS
Fallow	4	4	5	5	2	2	8	8
Rice	11	11	17	17	1	1	4	4
Soybean	13	13	46	26	10	10	25	25
BLH b/	45	54	16	36	71	71	33	33
Other c/	27	27	17	17	16	16	30	30

a/ Baseline and Corps future without-project projection.
b/ Bottom-land hardwoods.
c/ Includes cotton, cypress, unvegetated open water levees, and other categories that provide little or not foraging value.

TABLE SEIS-13
AVAILABLE WATERFOWL FORAGING HABITAT FOR
BASELINE AND CORPS AND FISH AND WILDLIFE SERVICE
FUTURE WITHOUT-PROJECT PROJECTIONS

Land Use	DUD/ acre	Reach 1		Reach 2		Reach 3		Reach 4	
		Corps	FWS	Corps	FWS	Corps	FWS	Corps	FWS
Fallow	1,037	186	0	109	0	51	0	203	0
Rice	580	510	0	370	0	26	0	101	0
Soybean	253	603	0	1,002	0	256	0	633	0
BLH a/	57	2,088	3,387	349	1,830	1,815	2,148	836	1,773
Total	N/A	3,387	3,387	1,803	1,830	2,148	2,148	1,773	1,773

a/ Bottom-land hardwoods.

TABLE SEIS-14
BASELINE DUCK-USE-DAYS (DUD) AND CORPS AND FISH AND WILDLIFE SERVICE (FWS) FUTURE WITHOUT-PROJECT DUD PROJECTIONS

Reach	Average Seasonal Duck Acres a/	Baseline DUD b/	Corps Future Without-Project DUD	FWS Future Without-Project DUD
1	3,387	760,257	760,257	426,879
2	1,830	601,032	601,032	370,890
3	2,148	236,190	236,190	182,376
4	1,773	476,892	476,892	269,721
Total	9,138	2,074,371	2,074,371	1,249,866

a/ Total across all habitat types in Table SEIS-13.
b/ Determined by multiplying the DUD/acre habitat values in Table SEIS-13 by the available habitat and summing across all habitat types.

TERRESTRIAL RESOURCES

107. Terrestrial habitats range from open agricultural monocultures to diverse and productive bottom-land hardwoods. Agricultural fields and edges between bottom-land hardwoods and agricultural fields provide habitat for some species. However, 273,398 acres of bottom-land hardwoods (including swamp cover type) provide the highest quality and most stable habitat. FWS classifies bottom-land hardwoods as Resource Category 2: "Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section." Terrestrial wildlife species associated with bottom-land hardwoods (e.g., deer, raccoon, woodpeckers, owls, various songbirds, rabbits, mice, wild turkey, squirrel and mink) are significant resources.

108. Habitat Evaluation Procedures (HEP) quantified habitat quality for terrestrial species (Table SEIS-15 and Appendix 12). The evaluation species represented a range of ecological value and wildlife habitat requirements for forested areas. The wood duck and mink evaluation species are water-dependent terrestrial species. On a scale of 0.0 (unsuitable habitat) to 1.0 (optimal), most habitat suitability index (HSI) values occurred between 0.50 and 0.90, indicating

above average habitat quality for most evaluation species. The pileated woodpecker had the highest HSI's and the mink the lowest. Habitat quality is limited by small tree diameters for barred owls, relative abundance of hard-mast producers for gray squirrels, small tree height for Carolina chickadees, lack of large-diameter trees for pileated woodpeckers, lack of brood habitat for wood ducks, and percent of the year with water present for the mink. Habitat units (HU) are determined by multiplying the acres of habitat by the HSI value.

TABLE SEIS-15
TERRESTRIAL HABITAT SUITABILITY INDEX (HSI) VALUES

Reach	Barred Owl	Gray Squirrel	Carolina Chickadee	Pileated Woodpecker	Wood Duck a/	Mink b/
1	0.70	0.58	0.65	0.79	0.58	0.11
2	0.78	0.60	0.76	0.89	0.47	0.12
3	0.91	0.64	0.74	0.93	0.41	0.12
4	0.75	0.62	0.63	0.73	0.47	0.11

a/ Wood duck HSI applies only to areas flooded from March through May each year (brood habitat).
b/ Mink HSI applies only to flooded >25% of the year at the 2-year frequency.

109. There are approximately 617,129 HU's under existing conditions. The Corps future without-project projection is 617,129 average annual habitat units (AAHU). The FWS future without-project projection is 673,791 AAHU, a 9.2 percent (56,662 AAHU) increase over the project life (Table SEIS-16). The FWS future without-project projection includes reforestation of 35,904 acres within the 2-year flood plain.

TABLE SEIS-16
BASELINE TERRESTRIAL AVERAGE ANNUAL HABITAT UNITS (AAHU) AND CORPS AND FISH AND WILDLIFE SERVICE (FWS) FUTURE WITHOUT PROJECT AAHU PROJECTIONS

Evaluation Species	Corps Forested Acres	FWS Forested Acres a/	Baseline HU	Corps Future Without-Project AAHU	FWS Future Without-Project AAHU b/
Non-water Dependent c/	197,200	233,104	577,796	577,796	629,713
Wood Duck d/	66,809	79,022	32,068	32,068	32,068
Mink e/	60,540	71,563	7,265	7,265	12,010
Total	N/A	N/A	617,129	617,129	673,791

a/ Includes 35,904 of reforestation within the 2-year flood plain.
b/ Baseline plus the value for acres reforested derived from Table 19, Appendix 12. MP4 was used for the non-water dependent species and MP5 for mink.
c/ Barred owl, gray squirrel, Carolina chickadee, and pileated woodpecker. The average HSI for each species across all reaches was used to determine baseline.
d/ Assumes 33.9 percent of forested acres is suitable habitat. No value added from reforestation because suitable nesting cavities would not be present.
e/ Assumes 30.7 percent of forested acres is suitable habitat.

WETLAND RESOURCES

110. In addition to the well-recognized wildlife value, wetlands provide short-term and long-term water storage, sediment detention, onsite erosion control, nutrient and dissolved substance removal and organic carbon export (Appendix 13).

111. Hydric soils were used to delineate farmed and forested wetlands (reference Appendix 13, Attachments 1 and 2). Farmed wetlands and prior-converted farmlands are lands cropped before 23 December 1985. Farmed wetlands still possess wetland functions and experience at least 15 consecutive days of growing-season inundation or saturation and prior-converted lands do not. Accordingly, prior-converted lands are not regulated by Section 404 of the Clean Water Act.

112. Farmed and forested wetlands account for 70 percent of the land base in the 2-year flood plain (Table SEIS-17). Forested wetlands account for 71 percent and farmed wetlands 29 percent of the functional wetlands.

TABLE SEIS-17
WETLAND DISTRIBUTION

Item	Acres	Percent
Farmed Wetlands	39,260	20
Forested Wetlands	96,405	50
Prior Converted	23,372	12
Nonhydric Lands	3,366	2
Other	29,820	16
Total	192,223	100

113. The maximum elevation at which backwater flooding influences the jursidictional delineation of wetlands in the study area is 88.5 feet, NGVD. The wetland analysis methodology provides a more conservative approach by including all wetlands up to the 91-foot elevation, NGVD (2-year frequency event). Therefore, wetland impacts beyond the jurisdictional wetlands were evaluated. The wetland methodology was developed at the Wetland Evaluation Work Unit of the Wetland Research Program at the U.S. Army Engineer Research and Development Center (Waterways Experiment Station) (Appendix 13). It evaluated short-term and long-term water storage, sediment detention, onsite erosion control, nutrient and dissolved substance removal, and organic carbon export. Forested and farmed wetlands were evaluated. Wetland functional changes were expressed as functional capacity units (FCU), which reflect the quantity and quality of wetland functional values. FCU's were determined by multiplying the functional capacity index (FCI) value for each function by the affected acreage. The FCI ranged from 0.0 to 1.0, with 1.0 representing optimal wetland functional value (Table SEIS-18).

TABLE SEIS-18
WETLAND FUNCTIONAL CAPACITY INDEX (FCI) VALUES

Function	Forested FCI	Farmed FCI	Reforestation FCI
Short-term water storage	1.0	0.90	0.08
Long-term water storage	1.0	0.45	0.44
Sediment detention	1.0	0.26	0.59
Onsite erosion control	0.67	0.04	0.50
Nutrient and Dissolved Substance Removal	0.67	0.10	0.46
Organic Carbon Export	1.0	0.60	0.32

114. To account for the modified hydrology from the pump operation and water management, wetland acres within the 2-year flood plain for all 12 months were converted to average daily flooded acres. Average daily flooded acres were determined by summing the number of acres flooded each day over the period of record (1943 to 1997) in the 2-year frequency and dividing the total by the number of days. The percentage of forested and farmed wetland in the 2-year flood plain (Table SEIS-19) were applied to the average daily flooded acres to determine the forested and farmed wetland average daily flooded acres. The percentage of forested and farmed was derived from a wetland delineation prepared by an interagency team, including EPA and the Natural Resources Conservation Service (Appendix 13). The net change between the with-and without-project projections of average daily flooded wetland acres represents the acres of wetlands gained or lost from changing the hydrology. This approach captures year-round flooding (which incorporates growing season flooding), and the upper ground elevation limit (91 feet, NGVD) is 1.5 feet above the elevation used to determine the jurisdictional limit of wetlands based on backwater flooding.

TABLE SEIS-19
RELATIVE WETLAND DISTRIBUTION (%) BY REACH FOR
BASELINE AND CORPS AND FISH AND WILDLIFE SERVICE (FWS)
FUTURE WITHOUT-PROJECT PROJECTIONS

Reach	Baseline and Corps Future Without-Project		FWS Future Without-Project a/	
	Forested	Farmed	Forested	Farmed
1	56	20	69	7
2	19	50	50	19
3	80	9	80	9
4	24	4	24	4

a/ Assumes 30,293 acres of farmed wetland in the 2-year frequency would be reforested without the project. These acres were divided equally between Reaches 1 and 2. The relative distribution of wetlands was adjusted to reflect this changed land use.

115. There are approximately 187,615 forested wetland FCU's and 31,485 farmed wetland FCU's under existing conditions and the Corps future without-project projections (Tables SEIS-20 and 21). The FWS future without-project projection for forested wetlands is 260,015 FCU's, a 38.6 percent increase over the project life.

TABLE SEIS-20
BASELINE FORESTED WETLAND FUNCTIONAL CAPACITY UNITS (FCU) AND CORPS AND FISH AND WILDLIFE SERVICE (FWS) FUTURE WITHOUT PROJECT FCU PROJECTIONS

Reach	Average Daily Flooded Acres a/	Baseline FCU b/	Corps Future Without Project FCU b/	FWS Future Without Project FCU c/
1	27,961	83,614	83,614	119,814
2	11,368	11,534	11,534	47,734
3	17,632	75,326	75,326	75,326
4	13,377	17,141	17,141	17,141
Total	70,338	187,615	187,615	260,015

a/ Multiply average daily flooded acres by forested percentages in Table SEIS-19 to determine forested acres for baseline and Corps.
b/ Multiply forested daily flooded acres by the cumulative forested wetland FCI/acre of 5.34 (from Table SEIS-18).
c/ The 30,293 acres were divided equally among Reaches 1 and 2, multiplied by 2.39 FCU's/ acre and added to the Baseline FCU.

TABLE SEIS-21
BASELINE FARMED WETLAND FUNCTIONAL CAPACITY UNITS (FCU) AND CORPS AND FISH AND WILDLIFE SERVICE (FWS) FUTURE WITHOUT-PROJECT FCU PROJECTIONS

Reach	Average Daily Flooded Acres a/	Baseline FCU b/	Corps Future Without-Project FCU b/	FWS Future Without-Project FCU
1	27,961	13,142	13,142	13,142
2	11,368	13,357	13,357	13,357
3	17,632	3,729	3,729	3,729
4	13,377	1,257	1,257	1,257
Total	70,338	31,485	31,485	31,485

a/ Multiply average daily flooded acres by farmed percentages in Table SEIS-19 to determine farmed acres for baseline and Corps and FWS future without-project.
b/ Multiply farmed daily flooded acres by the cumulative farmed wetland FCI/acre of 2.35 (from Table SEIS-18).

116. There are approximately 219,100 FCU's under existing conditions. The Corps future without-project projection is also 219,100 FCU's. The FWS future without-project projection is 291,500 FCU's, a 33 percent (72,400 FCU's) increase over the project life (Table SEIS-22).

TABLE SEIS-22
TOTAL BASELINE WETLAND FUNCTIONAL CAPACITY UNITS (FCU) AND CORPS AND FISH AND WILDLIFE SERVICE (FWS) FUTURE WITHOUT-PROJECT FCU PROJECTIONS a/

Reach	Baseline FCU	Corps Future Without-Project FCU	FWS Future Without-Project FCU
1	96,756	96,756	132,956
2	24,891	24,891	61,091
3	79,055	79,055	79,055
4	18,398	18,398	18,398
Total	219,100	219,100	291,500

a/ Forested and farmed wetlands.

AQUATIC RESOURCES

117. Fish communities are a mixture of the Yazoo River system and Lower Mississippi River ichthyofaunas. Studies of the Mississippi River, Steele Bayou, Upper Yazoo River, and Big Sunflower River indicate that a diverse ichthyofauna can potentially utilize the flood plain for spawning and rearing. Many of these fishes use the inundated flood plains as spawning, nursery, and foraging areas, and others reside year-round in permanent pools and oxbow lakes on the flood plain. (reference Appendix 10).

118. Twenty-three species of juvenile/adult fishes were collected in the study area in the spring and summer of 1994. The numerically dominant groups of gar, gizzard shad, common carp, buffalo, catfish, crappie, and freshwater drum are characteristic of Mississippi delta fish assemblages. Species richness was highest below Steele Bayou structure and lowest in Delta National Forest lakes. A total of 10,184 larval fishes representing 17 taxa were collected. Species richness was highest in the fringing flood plain connected to the outlet/inlet channel of the structure. Abundant larval fishes in the flood plain were buffalo, white crappie, shad,

freshwater drum, and sunfishes. Mean dissolved oxygen ranged from 4-5 milligrams per liter (mg/L) at all locations during sampling, but stratification occurred in the Delta National Forest lakes and behind the Steele Bayou structure. Fish kills were noted behind the structure during July 1994.

119. Habitat Evaluation Procedures were used to determine losses in flood plain spawning and rearing habitat for six species: blacktail shiner, small mouth buffalo, flathead catfish, largemouth bass, white crappie, and freshwater drum (Tables SEIS-23 and 24 and Appendix 10). The evaluation species represented a range of ecological value and fisheries flood plain habitat requirements. Spawning and rearing habitat was classified into five types: agricultural lands; bottom-land hardwood; scatters, brakes and tributary mouths; fallow land; and oxbow lakes. HSI values for each species and habitat combination were developed. On a scale of 0.0 (unsuitable habitat) to 1.0 (optimal), HSI values ranged from 0.04 to 0.98 for spawning habitat and 0.0 to 1.00 for rearing habitat.

TABLE SEIS-23
AQUATIC FLOOD PLAIN SPAWNING
HABITAT SUITABILITY INDEX (HSI) VALUES

Species	Flood Plain Habitat a/				
	AG	Fallow	BLH	Oxbows	SBT
Flathead catfish	0.04	0.11	0.71	0.61	0.92
Small mouth buffalo	0.42	0.8	0.85	0.9	0.89
Blacktail shiner	0.05	0.15	0.59	0.7	0.75
White crappie	0.25	0.64	0.74	0.96	0.93
Largemouth bass	0.19	0.51	0.86	0.98	0.97

a/ AG = agricultural land; BLH = bottom-land hardwoods; SBT = scatters, brakes, and tributary mouths.

TABLE SEIS-24
AQUATIC FLOOD PLAIN REARING
HABITAT SUITABILITY INDEX (HSI) VALUES

Species	Flood Plain Habitat a/				
	AG	Fallow	BLH	Oxbows	SBT
Flathead catfish	0.00	0.00	0.25	0.50	0.75
Small mouth buffalo	0.17	0.01	0.06	1.00	0.11
Blacktail shiner	0.00	0.00	0.03	0.00	1.00
White crappie	0.02	0.04	0.08	1.00	0.12
Largemouth bass	0.00	0.00	0.25	1.00	1.00
Freshwater drum	0.05	0.15	0.5	0.0	0.19

a/ AG = agricultural land; BLH = bottom-land hardwoods; SBT = scatters, brakes, and tributary mouths.

120. To account for the modified hydrology from the pump operation and water management, aquatic flood plain acres within the 2-year flood frequency for March, April, May, June (primary spawning and rearing timeframe) were converted to average daily flooded acres. Average daily flooded acres were determined by summing the number of acres flooded each day over the period of record (1943 to 1997) in the 2-year frequency and dividing the total by the number of days. The percentages of habitat types in the 2-year flood plain (Table SEIS-25) were applied to the average daily flooded acres to determine the average daily flooded acres for each habitat type. The net change between the with- and without-project projections of average daily flooded acres represents the acres of habitat gained or lost from modifying the hydrology on each habitat type.

121. There are approximately 200,107 spawning and 140,882 rearing HU's under existing conditions. The Corps future without-project projections are also 200,107 spawning and 140,882 rearing HU's. The FWS future without-project projections are 215,809 spawning and 150,431 rearing HU's, an increase of 7.8 percent (15,702 HU's) and 6.8 percent (9,549 HU's), respectively (Table SEIS-26).

TABLE SEIS-25
RELATIVE FLOOD PLAIN LAND USE DISTRIBUTION (%) BY REACH FOR BASELINE AND CORPS AND FISH AND WILDLIFE SERVICE (FWS) FUTURE WITHOUT-PROJECT PROJECTIONS

Reach	Baseline and Corps Future Without-Project a/					FWS Future Without-Project b/				
	AG	BLH	SBT	Fallow	Oxbows	AG	BLH	SBT	Fallow	Oxbows
1	28	48	7	4	13	18	59	7	3	13
2	73	18	3	5	1	51	40	3	5	1
3	12	74	11	5	1	12	74	11	5	1
4	45	33	12	9	1	45	33	12	9	1

a/ AG = agricultural land; BLH = bottom-land hardwoods; SBT = scatters, brakes, and tributary mouths.

b/ Assumes 30,293 acres of soybean land in the 2-year flood frequency would be reforested without the project. These acres were divided equally between Reaches 1 and 2. The relative distribution of agricultural land and bottom-land hardwoods was adjusted to reflect this changed land use.

TABLE SEIS-26
TOTAL BASELINE AQUATIC HABITAT UNITS (HU) AND CORPS AND FISH AND WILDLIFE SERVICE (FWS) FUTURE WITHOUT-PROJECT HU PROJECTIONS

Habitat	Average Daily Flooded Acres a/	Baseline HU b/	Corps Future Without-Project HU	FWS Future Without-Project HU
Spawning	72,316	200,107	200,107	215,809
Rearing	129,013	140,882	140,882	150,431

a/ Multiply average daily flooded acres by habitat percentages in Table SEIS-25 to determine habitat acres for baseline and Corps and FWS future without-project.

b/ The sum of the habitat acres multiplied by their respective HSI values from Tables SEIS-23 (spawning) and 24 (rearing).

THREATENED AND ENDANGERED SPECIES

122. The FWS identified the endangered plant pondberry (Lindera melissifolia) and the threatened Louisiana black bear (Ursus americanus luteolus) as species that may occur in the study area. Pursuant to Section 7 of the Endangered Species Act, a Biological Assessment was prepared (Appendix 14).

123. Pondberry was listed Federally as an endangered species on 31 July 1986 (Federal Register 51(47):27495-27500). It is a low-growing, deciduous shrub ranging in height from 1.5 to 6 feet. The plants commonly grow in clumps of numerous scattered stems somewhat resembling a "plum thicket." The most critical threat to pondberry, as with many endangered species, is the alteration/modification and/or loss of habitat. Three factors which constitute this threat are certain timber-harvesting practices, certain drainage activities, and land-clearing operations for agricultural, commercial, and private development. Appendix 14 provides detailed discussions about the pondberry's ecology and status. The pondberry profile (Appendix 14, Attachment 1) provides a comprehensive set of available literature, professional opinion, and survey data on pondberry ecology and life history.

124. The Mississippi Natural Heritage Program (MNHP) was asked to review its records for reported pondberry colonies within the Yazoo Backwater Project Area from 1996 to 1999. In a 31 January 2000 letter with an accompanying site map, MNHP noted 22 colonies of pondberry within the proposed project area. No colonies were in the areas of direct impact. During the period September-October 1994, field surveys for pondberry were conducted. The survey included the entire direct rights-of-way for the project and a 5 percent survey (2,000 acres) of forested tracts, with a high potential for pondberry occurrence, south and west of the Delta National Forest. In addition to pondberry profile report information (Appendix 14, Attachment 1), flood-frequency data, and professional judgment were utilized to select forested tracts to survey. A summary of the transects surveyed for pondberry is presented in Table 14-1. No pondberry colonies or evidence of pondberry presence was noted within either the rights-of-way or the 2,000 acres surveyed in 1994. Two colonies were discovered during surveys for two previous Yazoo Basin studies--Upper Yazoo Projects and Mississippi Delta. A colony containing six stems was located in Tallahatchie County, Mississippi, during the Upper Yazoo Projects, and a colony containing hundreds of stems was located in Bolivar County, Mississippi, during the Mississippi Delta study. In addition, 62 pondberry sites on Delta National Forest and private lands near Shelby and Merigold, Mississippi, were sampled in May and June 2000 (Appendix 14, Attachment 2). The objective of this data collection was to evaluate the relationship between pondberry colony characteristics and flood frequency.

125. The Louisiana black bear was listed as a Federally threatened species on 7 January 1992 (57:588-595). The Louisiana black bear is one of 16 recognized subspecies of the American black bear Ursus americanus. Other free-living bears of the species Ursus americanus within the same range of the Louisiana black bear have also been designated as threatened due to similarity of appearance. Black bears are primarily animals of heavily wooded areas. Destruction or modification of bottom-land hardwood habitat represents the most significant threat to the Louisiana black bear. In addition, habitat fragmentation has limited the potential for the present population to expand its current range. Appendix 14 provides detailed discussions about the Louisiana black bear's ecology and status. The MNHP in a 31 January 2000 letter with an accompanying site map reported the occurrence/sighting of black bear at seven locations within the project area.

CULTURAL RESOURCES

126. A literature and records search was conducted to ascertain whether any previously recorded or known prehistoric and historic cultural resources were located in or adjacent to the project study area and determine what types of cultural resources might be expected in the study area. All alternatives were considered in the cultural resources literature and records. The review was conducted in January 2000 and involved the examination of holdings housed at the Mississippi Department of Archives and History—the archeological site cards, the standing structure forms, the National Register of Historic Places (NRHP), and other pertinent documents and maps; e.g., soil survey data, cultural resource reports, local histories, U.S. Geological Survey topographic maps, and aerial photography. In addition, the Louisiana Division of Archaeology was consulted regarding the portion of Madison Parish located east of the Mississippi River.

127. Approximately 1,515 archeological sites have been recorded within the study area. These sites are listed by county/parish (Table SEIS-27). A total of 111 NRHP eligible properties have been listed within the study area (Appendix 15, Table 15-2). There have been 331 cultural

resource surveys conducted within the study area. The proposed pump structure site location has previously been subjected to a cultural resources survey and no significant cultural resources were identified

TABLE SEIS-27
ARCHEOLOGICAL SITES RECORDED WITHIN THE STUDY AREA
JANUARY 2000

County/Parish	Total Number of Recorded Archeological Sites	Total Number of National Register for Historic Places Sites	Total Number of Recorded Archeological Studies
Humphreys	207	4	46
Issaquena	106	2	16
Sharkey	149	5	31
Warren	205	62	73
Washington	286	17	54
Yazoo	342	10	71
Madison Parish, LA	220	11	40

WATER QUALITY

128. Surface water, sediment and fish tissue quality were analyzed. Detailed and complete water quality discussions and analyses are provided in Appendix 16.

129. Prior to 1990, little water quality data were available for the Steele Bayou Basin. During 1990 and 1991, the Research and Development Center and the U.S. Geological Survey collected water and/or sediment samples from 14 Steele Bayou Basin stations within the Yazoo Backwater Area.

130. From 1992 through 1995, the Vicksburg District collected water and/or sediment samples from 32 stations within the Big Sunflower River Basin. Samples were collected from the Big Sunflower River, Little Sunflower River, Dowling Bayou, and from four area lakes--Howlett Bayou, Lost Lake, Fish Lake, and Plaquemine Bayou. Water and sediment samples were

divided into four groups. The groups are based on selected reaches in which the sampling sites are located. The first group includes the Steele Bayou Basin from its mouth to the vicinity of the Highway 12 bridges over Black Bayou, Granicus Bayou, and Granny Baker Bayou. The second group includes the Big Sunflower River from its mouth to Dowling Bayou (Big Sunflower River Mile (RM 33), the downstream most 2 miles of Dowling Bayou, and the Little Sunflower River. The third group includes the Big Sunflower River from Dowling Bayou to the upper limit of the backwater area near Big Sunflower RM 65. The fourth group includes the four sampled lakes. These groupings were selected due to significant differences in various water and sediment quality parameters between the reaches of the Big Sunflower River upstream and downstream of Dowling Bayou.

131. A summary of the water quality data for the Steele Bayou Basin, the Big Sunflower River Basin, and for the four backwater lakes is contained in Table 16-2. Table 16-2 includes the in-situ data, turbidity, and the physicochemical parameters of total Kjeldahl nitrogen (TKN), total phosphorus, nitrate nitrogen, ammonia nitrogen, sulfate, total solids, and total suspended solids. Dissolved oxygen ranged from 1.6 to 16.1 milligram per liter (mg/l) with a mean of 7.04 mg/l. Of the 86 dissolved oxygen readings, 10 fell below the Mississippi Department of Environmental Quality (MDEQ) minimum benchmark of 5 mg/l. Specific conductance ranged from 49 to 950 umhos/centimeter (umhos/cm) with a mean of 350.9 umhos/cm. None of the 105 specific conductance readings exceeded the MDEQ benchmark of 1,000 umhos/cm. Turbidity ranged from 7 to 726 nephelometric turbidity unit (NTU) with a mean of 110.7 NTU. Of the 99 turbidity measurements, 15 exceeded the MDEQ benchmark of 150 NTU. Total Kjeldahl nitrogen (TKN) values ranged from 0.415 to 8.0 mg/l N with a mean of 1.91 mg/l N. Of the 106 TKN samples, 93 exceeded the MDEQ benchmark of 1 mg/l. Nitrate Nitrogen (NO3) concentrations ranged from 0.023 to 1.12 mg/l N with a mean of 0.482 mg/l N. Of the 27 samples with detectable levels of nitrate nitrogen, 5 samples exceeded the MDEQ benchmark of 1 mg/l. Total phosphorus levels ranged from 0.032 to 1.8 mg/l P with a mean of 0.391 mg/l P. Of the 100 samples with detectable levels of total phosphorus, 88 exceeded the MDEQ benchmark of 0.2 mg/l P.

132. Water samples were analyzed for the 19 priority pollutant pesticides (Appendix 16, Table 16-3). Only ppDDE, ppDDT, Heptachlor, Dieldrin, B-Endosulfan, and Endrin Aldehyde were detected. These pesticides were generally reported in trace amounts. The most common pesticides detected were ppDDE, ppDDT, Heptachlor, and Dieldrin. The three pesticides, ppDDE, Heptachlor, and Dieldrin, were detected in 20 of the 30 samples. The pesticide ppDDT was detected in 19 of the 30 samples. B-Endosulfan and Endrin Aldehyde were detected in only 2 of the 30 samples. All of the detected concentrations were trace amounts except a single sample collected from the Big Sunflower River at Highway 14, which had detectable concentrations of ppDDT (0.290 microgram per liter (µg/l) and B-Endosulfan (0.490 µg/l).

133. The metals concentrations for water samples collected are shown in Appendix 16 in Table 16-4, along with the EPA and the State of Mississippi criteria. The metals analyzed included 11 priority pollutant metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, silver and thallium) and 4 nonpriority pollutant metals (barium, cobalt, iron, and manganese). See Appendix 16 for detailed discussions.

134. Forty-four sediment samples were analyzed for the 19 priority pollutant pesticides (Table 16-3). Of these samples, 20 were collected from the lower Big Sunflower area, 6 from the upper Big Sunflower area, 7 from the backwater lakes, and 11 from the Steele Bayou Basin. The most frequently detected pesticides were ppDDT in 34 samples and both ppDDD and ppDDE in 42 of the 44 samples analyzed. DDT has been banned in the United States for over 25 years. However, the Mississippi Delta is an area of heavy agricultural production in which DDT was commonly used prior to 1972. DDT has a half-life of over 15 years, thus allowing for its continued presence in surface waters and sediment.

135. To determine the variability of pesticide concentrations with depth, sediment cores were collected at four locations within the Steele Bayou Basin. Each core sample was analyzed for the 19 priority pollutant pesticides. The pesticides ppDDD, ppDDE, and ppDDT were detected most frequently. The trend was for the higher concentrations to be located in the upper layers

while the lower concentrations were found in the underlying, deeper layers. However, an additional 25 segmented core samples were collected from the Little Sunflower Basin in 1998 and 1999, and a statistical analysis of pesticide concentration with depth found no significant differences with depth.

136. Trace metals were analyzed on 37 surface sediment samples collected within the backwater area. Twenty of these samples were collected from the lower Big Sunflower area, 6 from the upper Big Sunflower area, 7 from the backwater lakes, and 4 from the Steele Bayou basin. The sediment samples were analyzed for 11 priority pollutant metals and 4 nonpriority pollutant metals (Table 16-3). For most of the metals analyzed, concentrations were within the ranges that occur naturally. However, some of the samples contained arsenic, cadmium, and mercury in concentrations that exceeded the maximum concentrations as reported by Bowen and/or the U.S. Geological Survey.

137. Because the water and sediment samples collected in the backwater area contained high levels of several contaminants, a fish tissue sampling program was conducted in the Big Sunflower River basin during 1993 and 1994. Forty-nine fish specimens were collected including 5 paddlefish, 5 blue catfish, 5 flathead catfish, 10 short nose gar, 14 small mouth buffalo, and 10 bigmouth buffalo. These specimens were analyzed for both metals and pesticides (Table 16-6). Appendix 16, Table 16-7 lists the pesticides with detectable concentrations found within the tissue of fish collected. All 49 of the fish were tested for aldrin, A-BHC, D-BHC, methoxychlor, and chlordane. None of these pesticides were detected in any of the sampled fish. Endosulfan sulfate and endrin were detected in 1 fish, B-BHC and endosulfan I were detected in 2 fish, endosulfan II in 5 fish, heptachlor epoxide in 6 fish, G-BHC in 8 fish, heptachlor in 16 fish, dieldrin in 21 fish, toxaphene in 22 fish, and endrin aldehyde and ppDDE in 25 fish. Both ppDDD and ppDDT were detected in all 49 fish.

138. Although some observed metals levels in the sediment samples were high, these concentrations have not led to high metals concentrations in fish tissue (Table 16-8). This is because most metals in the sediments are not readily bioavailable. Therefore, the sediment concentrations of metals are not necessarily a good indicator of fish tissue quality.

ENVIRONMENTAL CONSEQUENCES

LAND USE

139. Under the Corps future without-project projection, the relative increase in bottom-land hardwood habitat in the study area ranged from 11.7 to 45.8 percent (Table SEIS-28). Under the FWS future without-project projection, the relative increase in bottom-land hardwood habitat ranged from 0.0 to 23.4 percent. The lower relative gains under the FWS future without-project result from the anticipated reforestation of 43,432 acres under primarily the Wetland Reserve Program. Under the Corps future without-project projection, the percentage decrease in agricultural lands ranged from 7.6 to 29.6 percent. Under the FWS future without-project projection, the percentage decrease in agricultural lands ranged from 0.0 to 20.3 percent.

140. There would be no increase in bottom-land hardwood habitat with the no-action alternative under the Corps future without-project projection. There would be an 18.1 percent increase in bottom-land hardwood habitat with the no-action alternative under the FWS future without-project projection. The recommended plan (Plan 5) would result in a 26.7 percent increase in bottom-land hardwood habitat and a 17.3 percent decrease in agricultural lands.

TABLE SEIS-28
EFFECT OF ALTERNATIVES ON LAND USE a/

Alternative	Change (%) Corps Future Without-Project		Change (%) FWS Future Without-Project b/	
	Bottom-land Hardwood	Agricultural	Bottom-land Hardwood	Agricultural
2	45.8	-29.6	23.4	-20.3
3	11.7	-7.6	10.0	-8.6
4	17.4	-11.2	0.0	0.0
5	26.7	-17.3	7.3	-6.3
6	33.0	-21.4	12.6	-11.0
7	45.8	-29.6	23.4	-20.3

a/ Based on the 100-year frequency (study area).
b/ The projected 43,432 acres of reforestation without the project was subtracted from the reforestation proposed for Plan 2 and Plans 4 through 7.

PRIME FARMLANDS

141. Pursuant to coordination requirements of the Farmland Protection Policy Act, the Natural Resources Conservation Service has been sent form AD-1006. It is anticipated that based on site assessment criteria which include the percent of the site being farmed, area in nonurban use, average farm size, creation of nonfarmable land, on-farm investments and compatibility with existing agricultural uses, that reforestation below 87 feet, NGVD, would have adverse impacts to farmlands because they would be permanently removed from row crop production.

WATERFOWL RESOURCES

142. In addition to the hydrologic and reforestation effects of Plans 3 through 7 on waterfowl foraging habitat, each plan would include 38 acres of bottom-land hardwood clearing from pump construction, disposal area construction, and the realignment of the bridge over the outlet channel. This results in a permanent loss of 2,166 DUD's (38 acres times 57 DUD/acre).

143. All alternatives would result in a net loss of available waterfowl foraging value. Under the Corps future without-project projection, the losses ranged from 9.2 to 45.2 percent (Table SEIS-29). Under the FWS future without-project projection, the change in foraging value ranged from a gain of 30.6 percent to a loss of 5.3 percent. Plans with nonstructural flood damage reduction (reforestation) had the greatest losses, and Plan 3, the structural plan, had the fewest losses under the Corps without-project projection. The plans with reforestation had greater losses because the value of the agricultural land to waterfowl foraging is greater than the waterfowl foraging value of bottom-land hardwoods. Therefore, for every acre reforested, there is a net loss of foraging value. However, the reforestation provides other waterfowl habitat requirements (Appendix 11) and helps achieve the North American Waterfowl Management Plan goals of bottom-land hardwood reestablishment.

TABLE SEIS-29
EFFECT OF ALTERNATIVES
ON WATERFOWL FORAGING VALUE

Alternative	Seasonal Daily Acres Impacted	Seasonal Daily Acres Reforested		Corps Net Effect		FWS Net Effect	
		Corps	FWS	DUD a/	Change (%)	DUD a/	Change (%)
2	0	4,050	4,050	-824,505	-39.8	0	0
3	-836	0	0	-191,100	-9.2	635,881	30.6
4	-814	3,697	4,050	-936,609	-45.2	-109,938	-5.3
5	-353	3,902	4,050	-873,432	-42.1	-46,761	-2.2
6	1,302	4,708	4,050	-634,017	-30.1	192,654	9.3
7	1,451	4,778	4,050	-612,924	-29.6	213,747	10.3

a/ Includes the loss of 2,166 DUD from the clearing of 38 acres at the pump site on Plans 3 through 7.

144. There would be no change in waterfowl foraging value with the no-action alternative under the Corps future without-project projection. There would be a 39.8 percent decrease with the no-action alternative under the FWS future without-project projection. The recommended plan would result in a 42.1 percent decrease in waterfowl foraging value.

TERRESTRIAL RESOURCES

145. Adverse effects to wildlife species dependent on bottom-land hardwood habitat result primarily from land use conversion (removal of habitat) or from altered hydrologic characteristics (reduced flood frequency and duration). Terrestrial resource value can also be increased through reforestation of agricultural lands (Appendix 12).

146. In addition to the hydrologic and reforestation effects of Plans 3 through 7 on terrestrial resource value, each plan would include 38 acres of bottom-land hardwood clearing from pump construction, disposal area construction, and the realignment of the bridge over the outlet channel. This would result in a permanent loss of 108 AAHU's.

147. All alternatives would result in gains in terrestrial resource value, except Plan 3. Under the Corps future without-project projection, the gains ranged from 12.1 to 29.4 percent (Table SEIS-30). Under the FWS future without-project projection, the gains ranged from 1.2 to 18.8 percent. Plan 3 would result in 1.1 percent increase in terrestrial value under the Corps future without-project projection and a 1.2 percent decrease under the FWS future without-project projection.

148. There would be no change in terrestrial resource value with the no-action alternative under the Corps future without-project projection. There would be an 9.2 percent increase with the no-action alternative under the FWS future without-project projection. The recommended plan would result in a 17.4 percent increase in terrestrial resource value.

TABLE SEIS-30
EFFECT OF ALTERNATIVES
ON TERRESTRIAL RESOURCE VALUE

Alternative	Acres Reforested		Corps Net Effect		FWS Net Effect	
	Corps	FWS a/	AAHU b/	Change (%)	AAHU c/	Change (%)
2	107,000	71,096	175,542	28.4	126,753	18.8
3	0	0	-6,680	-1.1	-7,692	-1.2
4	40,600	4,696	74,533	12.1	8,372	1.2
5	62,500	26,596	107,674	17.4	47,417	7.0
6	77,300	41,396	134,987	21.9	73,803	11.0
7	107,000	71,096	181,328	29.4	126,753	18.8

a/ 35,904 acres projected to be reforested without the project.
b/ Includes the loss of 108 AAHU's from the clearing of 38 acres at the pump site on Plans 3 through 7.
c/ Reforestation values for non-water dependent species determined by using the values in Table 19, Appendix 12. Assumes 33.9 percent of forested acres is suitable wood duck habitat and 30.7 percent of forested acres is suitable mink habitat. These are the percentages that occur under existing conditions.

WETLAND RESOURCES

149. In general, adverse wetland effects result from land use conversion (complete loss of function) or by changing hydrology (partial reduction in function). Wetland function value can also be increased on sites with appropriate hydrology through reforestation (Appendix 13).

150. In addition to the hydrologic and reforestation effects of Plans 3 through 7 on forested wetland resource value, each plan includes 38 acres of bottom-land hardwood clearing from pump construction, disposal area construction, and the realignment of the bridge over the outlet channel. This would result in a permanent loss of 203 FCU's (5.34 FCU/acre times 38 acres).

151. All alternatives, except Plan 3, would result in substantial gains in forested wetland functional value. Under the Corps future without-project projection, the gains ranged from

15.8 to 63.4 percent (Table SEIS-31). Under the FWS future without-project projection, the gains ranged from 6.3 to 53.8 percent. Plan 3 would result in a 28.2 decrease in forested wetland functional value under the Corps future without-project projection and 31.2 percent decrease under the FWS future without-project projection.

TABLE SEIS-31
EFFECT OF ALTERNATIVES
ON FORESTED WETLAND FUNCTIONAL VALUE

Alternative	Daily Acres Impacted		Daily Acres Reforested		Corps Net Effect		FWS Net Effect	
	Corps	FWS	Corps	FWS	FCU a/	Change (%)	FCU a/	Change (%)
2	0	0	32,602	27,324	77,919	41.5	65,304	34.8
3	-8,341	-10,199	0	0	-44,745	-23.8	-54,667	-27.0
4	-6,238	-7,628	26,455	22,094	29,714	15.8	11,865	6.3
5	-2,915	-3,605	29,524	24,701	54,795	29.2	39,582	21.1
6	3,691	4,201	34,861	32,627	102,825	54.8	91,751	48.9
7	5,023	5,903	38,645	29,087	118,981	63.4	100,834	53.8

a/ Includes the loss of 203 FCU from the clearing of 38 acres at the pump site on Plans 3 through 7.

152. There would be no change in forested wetland resource value with the no-action alternative under the Corps future without-project projection. There would be an 7.7 percent increase with the no-action alternative under the FWS future without-project projection. The recommended plan would result in a 29.2 percent increase in forested wetland resource value.

153. In addition to the hydrologic and reforestation effects of Plans 3 through 7, there would be 110.5 acres of farmed wetland at the pumps site that would be lost from pump and disposal area construction. This would result in the permanent loss of 260 FCU's (110.5 acres times 2.35 FCU/acre).

154. Plans 6 and 7 would provide a net gain in farmed wetland functional value. Under the Corps future without-project projection, the relative gains were 6.7 and 11.9 percent, respectively (Table SEIS-32). Under the FWS future without-project projection, the relative gains were

2.9 and 5.3 percent, respectively. Plans 3, 4, and 5 would provide a net loss in farmed wetland functional value. Under the Corps future without-project projection, the loss ranged from 10.4 to 27.0 percent. Under the FWS future without-project projection, the loss ranged from 5.2 to 13.1 percent.

TABLE SEIS-32
EFFECT OF ALTERNATIVES
ON FARMED WETLAND FUNCTIONAL VALUE

Alternative	Daily Acres Impacted		Daily Acres Reforested		Corps Net Effect		FWS Net Effect	
	Corps	FWS	Corps	FWS	FCU b/	Change (%)	FCU	Change (%)
2	0	0	0	0	0	0	0	0
3	-3,495	-1,637	0	0	-8,506	-27.0	-4,128	-13.1
4	-2,610	-1,220	0	0	-6,419	-20.4	-2,622	-8.3
5	-1,277	-586	0	0	-3,272	-10.4	-1,646	-5.2
6	1,000	490	0	0	2,103	6.7	900	2.9
7	1,697	817	0	0	3,741	11.9	1,669	5.3

a/ Includes the loss of 260 FCU from the clearing of 38 acres at the pump site on Plans 3 through 7.

155. There would be no change in farmed wetland resource value with the no-action alternative under the Corps future without-project projection. The recommended plan would result in a 10.4 percent loss in farmed wetland resource value.

AQUATIC RESOURCES

156. In general, adverse aquatic flood plain effects can result from land use conversion (complete loss of habitat) or by changing hydrology (partial reduction in habitat value). Aquatic flood plain spawning and rearing value can also be increased on sites with appropriate hydrology through reforestation (Appendix 10).

157. In addition to the hydrologic and reforestation effects of Plans 3 through 7 on spawning habitat value, there would 38 acres of bottom-land hardwood clearing from pump construction, disposal area construction, and the realignment of the bridge over the outlet channel. This would result in a permanent loss of 142 spawning HU's (3.75 HU's times 38 acres).

158. All alternatives would result in gains in aquatic flood plain spawning value, except Plan 3 under the Corps and FWS future without-project projection and Plan 4 under the FWS future without-project projection. Under the Corps future without-project projection, the gains ranged from 5.2 to 41.9 percent (Table SEIS-33). Under the FWS future without-project projection, the gains ranged from 11.5 to 33.4 percent. Plan 3 would result in a 31.8 decrease in aquatic flood plain spawning value under the Corps future without-project projection and 32.2 percent decrease under the FWS future without-project projection. Plan 4 under the FWS future conditions results in a 1.2 percent loss in flood plain spawning value, but a 5.2 percent gain under the Corps future conditions.

TABLE SEIS-33
EFFECT OF ALTERNATIVES
ON AQUATIC FLOOD PLAIN SPAWNING VALUE

Alternative	Daily Acres Impacted	Daily Acres Reforested		Corps Net Effect		FWS Net Effect	
		Corps	FWS	HU a/	Change (%)	HU a/	Change (%)
2	0	34,219	29,159	80,072	40.0	68,524	31.8
3	-23,539	0	0	-63,886	-31.8	-69,390	-32.2
4	-18,037	25,538	21,766	10,466	5.2	-2,626	-1.2
5	-10,998	28,840	24,478	37,425	18.7	24,825	11.5
6	-4,712	31,861	27,165	61,754	30.9	49,598	23.0
7	1,022	34,701	29,558	83,860	41.9	72,082	33.4

a/ Includes the loss of 142 HU from the clearing of 38 acres at the pump site on Plans 3 through 7.

159. There would be no change in aquatic flood plain spawning value with the no-action alternative under the Corps future without-project projection. There would be a 7.8 percent increase with the no-action alternative under the FWS future without-project projection. The recommended plan would result in a 18.7 percent increase in aquatic flood plain spawning value.

160. In addition to the hydrologic and reforestation effects of Plans 3 through 7 on rearing habitat value, there would be 38 acres of bottom-land hardwood clearing from pump construction, disposal area construction, and the realignment of the bridge over the outlet channel. This would result in a permanent loss of 44 rearing HU's (1.17 HU/acre times 38 acres).

161. All alternatives would result in gains in aquatic flood plain rearing value, except Plan 3 under the Corps and FWS future without-project projection and Plan 4 under the FWS future without-project projection. Under the Corps future without-project projection, the gains ranged from 0.2 to 34.4 percent (Table SEIS-34). Under the FWS future without-project projection, the gains ranged from 9.1 to 28.0 percent. Plan 3 would result in a 30.5 decrease in aquatic flood plain spawning value under the Corps future without-project projection and 30.6 percent decrease under the FWS future without-project projection. Plan 4 under the FWS future conditions results in 1.4 percent loss in flood plain rearing value, but a 0.2 percent gain under the Corps future conditions.

TABLE SEIS-34
EFFECT OF ALTERNATIVES
ON AQUATIC FLOOD PLAIN REARING VALUE

Alternative	Daily Acres Impacted	Daily Acres Reforested		Corps Net Effect		FWS Net Effect	
		Corps	FWS	HU a/	Change (%)	HU a/	Change (%)
2	0	60,578	51,094	41,730	29.6	35,255	23.4
3	-40,391	0	0	-42,957	-30.5	-46,083	30.6
4	-29,676	46,164	46,164	238	0.2	-2,058	-1.4
5	-15,073	52,979	44,699	20,607	14.6	13,701	9.1
6	-3,043	58,542	49,349	37,671	26.7	31,052	20.9
7	4,652	62,530	52,741	48,429	34.4	42,042	28.0

a/ Includes the loss of 44 HU's from the clearing of 38 acres at the pump site on Plans 3 through 7.

162. There would be no change in aquatic flood plain spawning value with the no-action alternative under the Corps future without-project projection. There would be a 6.8 percent increase with the no-action alternative under the FWS future without-project projection. The recommended plan would result in a 14.6 percent increase in forested wetland resource value.

THREATENED AND ENDANGERED SPECIES

163. The FWS identified the endangered plant pondberry (Lindera melissifolia) and the threatened Louisiana black bear (Ursus americanus luteolus) as species that may occur in the study area. Pursuant to Section 7 of the Endangered Species Act, a Biological Assessment (BA) was prepared (Appendix 14). The BA concluded that the proposed action is not likely to adversely affect the pondberry or Louisiana black bear. The reforestation of 62,500 acres under the proposed action should provide substantial potential habitat to aid in the recovery of both species.

164. Land clearing and the practice of clear-cut timber harvesting pose the greatest potential threat to the endangered pondberry. The recommended plan would not induce land clearing or contribute to promoting timber practices detrimental to the pondberry. Implementation of the recommended plan would impose no direct impacts on the pondberry plant since no pondberry plants were observed within the construction rights-of-way.

165. Previous field surveys and consultation with experts indicate that local hydrology is more important to the growth and health of pondberry than overbank flooding. Only those drainage activities which significantly alter the local hydrological regime of depressions, ponds, sinks, or other areas governed by localized hydrology would affect pondberry colonies. The project will change the flood frequency of most pondberry sites, although all sites will still occur in the same range of flood frequencies that occur under existing conditions. Analysis of pondberry data collected on 62 sites in May and June 2000 indicated no significant relationship between

pondberry colony characteristics and frequency of flooding (Appendix 14, Attachment 2). Implementation of the recommended plan would not alter the hydrological regime of ponds, sinks, or other areas governed by local hydrology.

166. The reforestation via conservation easements on 62,500 acres of open land below the proposed pump elevation would beneficially impact the endangered pondberry by reestablishing the dominant habitat association for pondberry populations in Mississippi.

167. Destruction or modification of bottom-land hardwood habitat represents the most significant threat to the Louisiana black bear. In addition, habitat fragmentation has limited the potential for the present population to expand its current range. Direct impacts associated with project implementation would occur at the construction site (110.5 acres of open land, 38 acres of woods, and 5.2 acres of water). The wooded portion of the proposed construction site was surveyed for signs of bear activities in February 2000 by Corps biologists. No evidence of bear activity; e.g., scratch marks on trees or suitable denning sites, was observed. Thus, construction associated with implementation of the recommended plan is not likely to adversely affect the Louisiana black bear.

168. Integral to the proposed project is the reestablishment of bottom-land hardwoods via conservation easements on 62,500 acres of open land below the pump elevation. This feature would significantly complement the FWS Recovery Plan for the Louisiana black bear by (a) reestablishing habitat highly suited to the black bear, and (b) providing additional cover to facilitate the movement of bears between the highly fragmented forest habitats of the Mississippi River Delta.

CULTURAL RESOURCES

169. An intensive cultural resource survey will be conducted over the property contained within the 62,500 acres and its Area of Potential Effect to identify all cultural resources. Survey methods will include remote-sensing technologies; e.g., satellite and low aerial imagery, as well as conventional ground-truthing methods(soil coring, hand excavation). All identified resources

will then be evaluated for their NRHP significance. If NRHP eligible properties are determined to be within the project areas rights-of-way or Area of Potential Effect, the effects of the project to the resources will be assessed. Efforts will be taken to either preserve the significant resources in place or mitigate appropriately for any adverse effects created by the undertaking.

WATER QUALITY

170. Based on all available data, the water quality in the Yazoo Backwater area streams and lakes is largely affected by extensive agricultural development. All the collected data support the MDEQ assessment that toxic and nontoxic nonpoint pollutants impair the surface waters.

171. Toxic pollutants include mercury and several agricultural pesticides including DDT. The chlorinated pesticides used years earlier persist in the water, soils, and fish tissue in the project area. Nontoxic pollutants include nutrients and suspended solids. The surface waters are high in turbidity and have high concentrations of nitrates and phosphorous. Nutrients and suspended solids are highest in reaches draining mostly agricultural runoff. Most of the streams and lakes within the Yazoo Backwater area have been reported by the state to be only partially supportive for the propagation of wildlife, fish, and other aquatic life. The predominant reason cited for partial support is nontoxic, nonpoint source pollution containing high loads of suspended solids and nutrients.

172. Water quality and sediment data collected within the backwater area indicate a greater tendency for pesticides to be found in the sediments than in the surface waters. The pesticides most frequently detected in the sediments were DDT, DDD, DDE, dieldrin, and heptachlor. Other pesticides detected in the sediments were endosulfan (A&B), endosulfan-sulfate, endrin, endrin aldehyde, aldrin, G-BHC, B-BHC, D-BHC, and heptachlor epoxide. Comparison to historical samples reveals that the levels reported and the frequency of detection of pesticides were considerably lower than those reported 20 to 25 years ago.

173. The major long-term water quality problems in the Yazoo Backwater Area are the result of the basin's intensive agricultural development. Thus, nonpoint source pollution control practices should be used. Control structures serving as sediment traps and the use of vegetative buffer strips around streams and ditches would help improve the area's water quality. The reforested project lands, as well as future U.S. Department of Agriculture's set-aside program lands, that are located along streams and ditches could significantly improve water quality. These lands will turn croplands into grass covered or forest lands. Conversion of cropland to grassland or forest reduces the amount of contaminants that are available to be washed into area water bodies. Grasslands and forest lands act as traps for contaminants instead of providing a source of contaminants. Conversion of cropland to forest land will likely increase the amount of methyl-mercury produced and could lead to increased mercury levels in fish tissue. In addition, enhanced education of the agricultural community regarding the importance of proper tillage practices on improving water quality within the Yazoo Backwater area should be developed.

SUMMARY OF EFFECTS

174. Except for Plan 3, the nonstructural flood damage reduction measure (reforestation) had the greatest influence on the net effect of each plan under the Corps and FWS future without-project projections (Tables SEIS-35, 36, and 37). Under the Corps future without-project projections, reforestation contributed an increase in terrestrial, wetland, and aquatic resource value across all nonstructural and combination plans and resource categories. Waterfowl foraging value decreased for all nonstructural and combination plans. This results from replacing relatively higher foraging value cropland with lower foraging value bottom-land hardwoods.

175. Hydrologic effects varied by resource category and plan. Hydrologic effects were positive on Plans 6 and 7 for all resource categories, except for Plan 6 on aquatic resources. Hydrologic effects were negative on Plans 3 through 5 for all resource categories.

TABLE SEIS–35
SUMMARY OF CONVERSION (CON), HYDROLOGIC (HYD), AND REFORESTATION (REF) EFFECTS
FOR ALL RESOURCE CATEGORIES

Alternative	Terrestrial (AAHU)			Wetland (FCU)			Waterfowl (DUD)			Aquatics (HU) a/		
	CON	HYD	REF	CON	HYD	REF	CON	HYD	REF	CON	HYD	REF
2	0	0	175,542	0	0	77,919	0	0	-824,505	0	0	80,072
3	-108	-6,572	0	-463	-52,788	0	-2,166	-188,934	0	-142	-63,744	0
4	-108	-3,832	78,473	-463	-39,469	63,227	-2,166	-184,086	-750,357	-142	-49,151	59,759
5	-108	-2,896	110,678	-463	-18,579	70,562	-2,166	-80,438	-790,828	-142	-29,919	67,489
6	-108	1,183	133,912	-463	22,072	83,318	-2,166	326,326	-958,177	-142	-12,659	74,555
7	-108	3,721	177,715	-463	30,824	92,362	-2,166	362,462	-973,220	-142	2,802	81,200

a/ Flood plain spawning habitat had greater impacts than rearing habitat value and was used to determine compensatory mitigation and the minimum threshold of reforestation required under Plans with negative hydrologic effects.

TABLE SEIS-36
SUMMARY OF NET EFFECTS
FOR ALL RESOURCE CATEGORIES
CORPS FUTURE WITHOUT-PROJECT PROJECTIONS

Alternative	Terrestrial (AAHU)	Wetland (FCU)	Waterfowl (DUD)	Aquatics (HU) a/
2	175,542	77,919	-824,505	80,072
3	-6,680	-53,251	-191,100	-63,886
4	74,533	23,295	-936,609	10,466
5	107,674	51,520	-873,432	37,428
6	134,987	104,927	-634,017	61,754
7	181,328	122,723	-612,924	83,860

a/ Flood plain spawning.

TABLE SEIS-37
SUMMARY OF NET EFFECTS
FOR ALL RESOURCE CATEGORIES
FWS FUTURE WITHOUT-PROJECT PROJECTIONS

Alternative	Terrestrial (AAHU)	Wetland (FCU)	Waterfowl (DUD)	Aquatics (HU) a/
2	126,753	65,304	0	68,524
3	-7,692	-58,795	635,881	-69,390
4	8,372	9,243	-109,938	-2,626
5	47,417	37,936	-46,761	24,825
6	73,803	92,651	192,654	49,598
7	126,753	102,503	213,747	72,082

a/ Flood plain spawning.

176. Conversion effects from the bottom-land hardwood clearing at the pump site occurred on Plans 3 through 7 and accounted for a relatively small loss across all resource categories.

177. The net effect of the nonstructural (Plan 2) and combination plans (Plans 4 through 7) was a net increase in value across all resource categories, except the waterfowl resource. The net increase in terrestrial resource value ranged from 12.1 to 29.4 percent. The net increase in wetland resource value ranged from 10.6 to 56.0 percent. The net decrease in waterfowl resource value ranged from 29.6 to 45.2 percent. The net increase in aquatic resource value ranged from 5.2 to 41.9 percent. Plan 3 (structural) provides a terrestrial resource value decrease of 1.1 percent, a wetland resource value decrease of 24.3 percent, a waterfowl resource value decrease of 9.2 percent, and a aquatic resource value decrease of 31.8 percent. The recommended plan provides a 17.4 percent increase in terrestrial resource value, a 23.5 percent increase in wetland resource value, a 42.1 percent decrease in waterfowl resource value, and a 18.7 percent increase in aquatic resource value.

CUMULATIVE EFFECTS

178. The Council on Environmental Quality's regulations implementing the procedural provisions of NEPA define cumulative effects as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR 1508.7). The area affected by the project is defined as the project impact zone. For the purposes of this analysis, the project impact zone is defined as the Backwater Project Area. This analysis addresses cumulative effects on terrestrial, waterfowl, wetlands, aquatics, water quality, threatened and endangered species and compensatory mitigation.

Past Actions

179. Prior to the European settlement of the Backwater Project Area, the entire area was a mosaic of bottom-land hardwoods, swamps, rivers and lakes. Assuming that all present-day

agricultural land was once forested, another 632,786 acres of bottom-land hardwoods and swamps would have existed. This represents a 68 percent loss of bottom-land hardwood forest in the Backwater Project Area. A number of past, present, and future actions have or will have the potential to impact the Backwater Project Area (Table SEIS-38). These actions contain features that have or could have direct or indirect impacts.

TABLE SEIS-38
PAST, PRESENT, AND FUTURE ACTIONS

Past Actions	Present Actions	Future Actions
Mississippi River Levee	Mississippi River Levee	Mississippi River Levee
Backwater Levee, Connecting Channel and Structure	Upper Steele Bayou Project	Backwater Levee
Will Whittington Auxiliary Channel and Levees	Big Sunflower Maintenance Project	Wetland and Conservation Reserve Programs
Big Sunflower Project	Wetland and Conservation Reserve Programs	Clean Water Act
Agricultural Production	Mitigation	Swampbuster
Acquisition of Public Lands	Clean Water Act	Acquisition of Public Lands
	Swampbuster	Lake George Restoration
	Acquisition of Public Lands	

180. Construction of the mainline Mississippi River levee; backwater levee, connecting channel and structure; and the original work on the Big Sunflower Project has to various degrees reduced the historic hydrology in the Backwater Project Area. These changes in hydrology have contributed to bottom-land hardwood clearing for agricultural production. In addition, construction of the backwater levee and the original Big Sunflower Project contributed to the direct loss of bottom-land hardwood from clearing. Compensatory mitigation for the unavoidable impacts from the construction of the backwater levee has been determined. The purchase of the Lake George property (8,800 acres) was mitigation for these impacts. However, in subsequent discussions with FWS, it was agreed that additional mitigation is owed on this project and will be accomplished under this report (see Main Report and Mitigation Appendix for more information).

181. Conservation of the bottom-land hardwoods has also occurred in the past through acquisition of National Wildlife Refuges, a National Forest and state wildlife management areas. These areas are listed under the SIGNIFICANT RESOURCES section. In addition, compensatory mitigation lands (reforested agricultural lands) have been established in the Backwater Project Area. The Lake George and Big Twist properties include approximately 15,400 acres of reforestation of agricultural lands. The Mahannah and Twin Oaks properties were acquired for mitigation of the Tennessee-Tombigbee Waterway and includes approximately 18,500 acres of both agricultural lands and bottom-land hardwoods.

Present Actions

182. Two other water resource projects occur in portions of the Backwater Project Area: The Upper Steele Bayou Project is currently under construction, and maintenance work is being conducted on the Big Sunflower River. These impacts from these projects are included in Supplement 1 to the Revised Final EIS, Upper Steele Bayou Project and Supplement 2 to the Final EIS, Big Sunflower River Maintenance Project. A comparison of the effects of these activities on significant resources along with the estimated effects of the Backwater Area Project is presented in Table SEIS-39. Landside levee enlargement, berm construction, and relief well installation on the Mississippi River levee could also occur along the western boundary of the Backwater Project Area. These impacts are analyzed in Supplement No. 1 to the Final Environmental Impact Statement, Mississippi River and Tributaries Project, Mississippi River Levees and Channel Improvement.

183. The Wetland and Conservation Reserve Programs (WRP and CRP) have restored habitat in the Backwater Project area. Approximately 22,535 acres of agricultural lands are enrolled in the WRP and 3,478 acres are enrolled in the CRP. In addition, the acquisition of additional National Forest, National Wildlife Refuge, and mitigation lands continues in the study area although to a smaller extent than in the past.

TABLE SEIS-39
COMPARISON OF WATER RESOURCES
PROJECTS IN THE STUDY AREA

Resource	Upper Steele Bayou	Big Sunflower	Backwater
Terrestrial	9 percent decrease in habitat.	<1 percent decrease in habitat.	22.8 percent increase in habitat.
Waterfowl	105 percent increase in foraging habitat value	10.6 percent decrease in foraging habitat value.	42.1 percent decrease in foraging habitat value. a/
Wetlands	9 percent decrease in wetlands.	<1 percent decrease in forested and farmed wetlands.	42.0 percent increase in forested wetland average daily acres
Aquatics	105 percent increase in instream habitat value.	10 percent decrease in flood plain habitat.	18.7 percent increase in flood plain habitat value
Water quality	Short-term construction impacts. Long-term improvement.	Short-term construction impacts. No long-term effects.	Reforestation should reduce nutrient and sediment loading. May increase methyl-mercury production which could elevate mercury levels in fish tissue.
Threatened and endangered species	No direct or indirect impacts to pondberry.	No direct or indirect impacts to pondberry, pallid sturgeon or Louisiana black bear.	No direct or indirect impacts. Increase in Louisiana black bear and pondberry habitat.
Compensatory mitigation	5,250 acres of reforestation. Fully offset terrestrial and wetland losses. Net gain of 2,684 acres of forested wetlands.	1,912 acres of reforestation. Fully offset wetlands and fisheries impacts. Net gain of 1,090 acres of terrestrial habitat. Net gain of 957 acres of bottom-land hardwood waterfowl foraging habitat.	Although compensatory mitigation is not required, the nonstructural flood control component includes reforestation of 62,500 acres of agricultural land below elevation 87 feet, NGVD.

a/ Although reforestation results in a loss of waterfowl foraging habitat, there are other important waterfowl habitat requirements that are met with reforestation (loafing, pair bonding, shelter, etc.) and that are notably absent in agricultural fields. According to FWS, the overall benefit that results from reforestation far exceeds losses of foraging habitat (Appendix 11).

184. Legislative authorities and Executive Orders have addressed the issue of wetland protection in recent years. Section 404 of the Clean Water Act requires permits for the discharges of dredged or fill material into waters of the United States. The Food Security Act of 1985 (referred to as "Swampbuster") removed some incentives for wetland development by eliminating agricultural subsidies to parties that produce commodities on wetlands converted after enactment. Executive Order 11990 directs Federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands if a practical alternative exists. Executive Order 11988 directs Federal agencies to reduce flood loss risk; minimize impacts on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by flood plains. If the only practical alternative requires action in the flood plain, agencies must design or modify their action to minimize adverse impacts. These authorities and orders have and will continue to protect and restore wetlands in the study area.

Future Actions

185. The backwater levee is a separate, completed feature of the Backwater Project. It is anticipated that this levee will need to be raised at some point during the 50-year project life of the recommended plan. The backwater area serves as a flood storage area under certain high flood conditions on the Mississippi River and is designed to overtop; therefore, the backwater levee height is set 2 feet below the height of the Mississippi River levee. Portions of the Mississippi River levee are being raised over the next 31 years to ensure the project design flood on the Mississippi River can be safely passed. This requires the backwater levee to be raised. Additional clearing of bottom-land hardwoods would occur to accommodate the larger footprint of the levee. Although the project would be designed to avoid clearing of bottom-land hardwoods for borrow areas to the extent practicable, it is likely that additional bottom-land hardwoods would be impacted from borrow area construction. Effects would occur from direct impacts only. The extent of clearing will not be known until the planning phase of that project. Appropriate NEPA documentation will be prepared to analyze the project's effects.

186. One environmental restoration project is expected to be constructed. The Lake George restoration project includes a weir in the Lake George design to maintain a minimum pool of water and restore and sustain the aquatic community in Lake George through the annual low-water period. This project will provide significant gains in aquatic resource value in Lake George.

187. The Corps future without project projection does not include any additional WRP or CRP lands, but the FWS service estimates that an additional 42,423 acres would be restored. The acquisition of additional National Forest, National Wildlife Refuge, and mitigation lands is expected to continue. The legislative authorities and Executive Orders addressing the issue of wetland protection are expected to remain in effect.

188. The recommended plan includes a 14,000-cfs pump with a year-round pumping elevation of 87 feet, NGVD, at the Steele Bayou structure and acquisition of conservation easements and reforestation on 62,500 acres of agricultural land below 87 feet, NGVD. The pump provides structural flood damage reduction above 87 feet, NGVD, and the reforestation provides nonstructural flood damage reduction below 87 feet, NGVD. Operation of the drainage structure at Steele Bayou would also be modified to maintain a 70- to 73-foot elevation during low-water periods. This would make available more water in the Steele Bayou channel during critical low-water periods.

189. Although adverse effects to environmental resources would result from the operation of the pump, the nonstructural flood damage measure (reforestation) provides substantial environmental benefits. The net effect of the structural and nonstructural flood damage reduction measures is a net increase of 18.7 percent in aquatic resource value, 23.5 percent increase in wetland resource value, 17.4 percent increase in terrestrial resource value, and a 42.1 percent decrease in waterfowl foraging resource value (other waterfowl habitat benefits are derived).

190. The incremental impact of the proposed action, when added to former, present, and foreseeable future actions, results in a net gain in nationally significant habitat and environmental values in the study area. Although the nonstructural flood damage reduction feature (reforestation) would significantly reduce the waterfowl foraging habitat value, the benefits of the reforestation to other waterfowl habitat requirements produce a net benefit to the waterfowl resource. The recommended plan provides a net an increase in terrestrial, wetland, and aquatic resource values such that no significant cumulative adverse environmental impact results on an ecosystem, landscape or regional scale when the proposed action is considered in conjunction with other activities (Table SEIS-40). The recommended plan would contribute to the long-term goal of habitat restoration and address the flood control needs of the study area.

MITIGATION

191. Mitigation is the process of avoiding, minimizing, and compensating adverse impacts. Environmental design and other measures have been incorporated to avoid and/or reduce adverse impacts. See the ENVIRONMENTAL DESIGN AND MEASURES TO MINIMIZE IMPACTS section for details. Although compensatory mitigation is not required for all plans, the number of acres requiring reforestation to achieve a no net loss of resources was estimated (in the event all of the acres estimated for reforestation on the combination plans could not be acquired). In addition, the Vicksburg District agreed with the local FWS Ecological Services Office to reanalyze the mitigation required for the previously constructed Yazoo Backwater Levee Project. (See Appendix 1 for a detailed mitigation analysis.)

TABLE SEIS-40
POTENTIAL CUMULATIVE EFFECTS
RECOMMENDED PLAN

Potential Impact Area	Pump Construction	Operation	Reforestation	Past Actions	Other Present Actions	Future Actions	Cumulative Impact
Terrestrial	*	*	+++	***	*	*	+
Waterfowl	*	**	***	***/+++	+	*	?
Wetlands	*	**	+++	***	+	*	+
Aquatic	*	**	+++	***	+	*	+
Water Quality	*	?	++	**	+	?	+
Threatened and Endangered Species	*	?	++	***	+	?	+
Compensatory Mitigation				+	+	+	+

KEY: * low adverse effect; ** moderate adverse effect; *** high adverse effect; + low beneficial effect; ? no effect; ++ moderate effect; +++ high beneficial effect.

192. Only Plan 3 requires compensatory mitigation (Table SEIS-41). Plans 4 through 7 would require a minimum number of acres to be reforested through easements in order to achieve a no-net-loss of environmental resource value. The Corps is committed to the fee title acquisition and reforestation of lands to achieve a no net loss of environmental value should this minimum number of acres of reforestation not be achieved. Compensatory mitigation and the minimum number of acres to reforest would be greater under the FWS future without-project projection (Table SEIS-42).

TABLE SEIS–41
COMPENSATORY MITIGATION AND MINIMUM THRESHOLD FOR NONSTRUCTURAL REFORESTATION UNDER CORPS FUTURE WITHOUT-PROJECT PROJECTIONS

Alternative	Compensatory Mitigation (acres)	Minimum Threshold a/ (acres)
Plan 1	None	None
Plan 2	None	None
Plan 3	27,435	27,435
Plan 4	None	21,199
Plan 5	None	12,980
Plan 6	None	5,604
Plan 7	None	194

a/ Number of acres to reforest to achieve a no-net-loss of environmental resource value.

TABLE SEIS–42
COMPENSATORY MITIGATION AND MINIMUM THRESHOLD FOR NONSTRUCTURAL REFORESTATION UNDER FWS FUTURE WITHOUT-PROJECT PROJECTIONS

Alternative	Compensatory Mitigation (acres)	Minimum Threshold a/ (acres)
Plan 1	None	None
Plan 2	None	None
Plan 3	29,787	29,787
Plan 4	None	23,022
Plan 5	None	14,015
Plan 6	None	6,103
Plan 7	None	194

a/ Number of acres to reforest to achieve a no-net-loss of environmental resource value.

193. Two additional items involving past work were addressed (Appendix 1). The reanalysis of the Yazoo Backwater Levee project determined that an additional 3,617 acres of reforestation are required to fully offset terrestrial losses. In addition, there was 296 acres cleared as part of the inlet and outlet channel construction in 1987. The compensatory mitigation for this increment of work is 481 acres of reforestation. To compensate these losses, the first 4,098 acres acquired and reforested through easements would be credited toward these losses. The Corps is committed to the fee title acquisition and reforestation of lands should this number of acres of reforestation not be achieved through easements.

194. A minimum of 17,078 acres of reforestation through easements is required to achieve a no-net-loss of environmental resources with implementation of the recommended plan, fully compensate previous Yazoo Backwater Area levee impacts, and compensate the 1986 clearing of bottom-land hardwoods at the pump site.

SECTION 122 ITEMS

195. The 1970 River and Harbors Act, Section 122, requires impacts on the following items be addressed.

Noise

196. Except for agricultural activities and recreational vehicles, the study area is a relatively noise-free rural environment. There would be minimal noise associated with the operation of the pump. There would be no significant change in noise levels in the project area.

Displacement of People

197. The project would reduce flooding and the associated financial and psychological hardships. None of the alternatives should result in the displacement of any households.

Esthetic Values

198. Because the Steele Bayou structure is at the pump site, the addition of the pump station would not affect the existing esthetic value at the site. Reforestation of 62,500 acres of agricultural land should improve the esthetic value of the natural environment.

Community Cohesion

199. The cultural heritage of the study area is linked to a predominantly agricultural-based lifestyle. The stability of this lifestyle is based on the continuation of an agricultural economy. Flood reduction in communities would ensure the continued existence of the agricultural economy and reduce the fragmentation and duress on individuals, families, and communities.

Local Government Finance, Tax Revenues, and Property Values

200. Local government finance considers tax bases, property values and tax revenues. These items impact the financial condition of local governmental units and often determine the level and quality of necessary local public services. Reforestation on 62,500 acres of agricultural lands would reduce tax revenues of the counties in the study area. This is because agricultural lands are taxed at a higher rate than forested land.

Displacement of Businesses and Farms

201. Reforestation of 62,500 acres of agricultural lands would remove these acres from local farms.

Public Services and Facilities

202. Local governmental units provide basic public services including education, police protection, various county social welfare services, and road and bridge maintenance. Services that are dependent on county taxes would be adversely impacted from the reduction in tax revenues.

Community and Regional Growth

203. The project would not significantly affect community and regional growth, but reduced flood risk would contribute to area stability and enhancement.

Employment

204. Construction, operation, and maintenance of the pump station would have a short-term positive impact on employment. Employment impact would occur during the 3-year construction period, but no long-term effect from project-related employment is expected.

Air Quality

205. The pumps would be powered by diesel engines. There would be periodic emissions at the pump site. The project would not affect long-term air quality.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF SOCIETY'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

206. Historically, flood control benefits and adverse environmental impacts represented trade-offs between the local short-term use and the long-term stability and productivity of society's environment. The recommended plan, however, represents a balanced approach to solving the flood damage reduction and environmental opportunities in the study area.

207. The recommended plan reduces average annual flood damages to built-up and agricultural areas through a combination of structural and nonstructural flood damage reduction measures, minimizes adverse impacts through project design, and provides a net gain in environmental value.

208. Although adverse effects to environmental resources would result from the operation of the pump and the clearing of 38 acres of bottom-land hardwoods, the nonstructural flood damage measure (reforestation) provides substantial environmental benefits. The net effect of the structural and nonstructural flood damage reduction measures is a net increase of 18.7 percent in aquatic resource value, 23.5 percent increase in wetland resource value, 17.4 percent increase in terrestrial resource value, and a 42.1 percent decrease in waterfowl resource value.

209. Structural flood damage reduction is being provided above elevation 87 feet, NGVD, and nonstructural flood damage reduction is being provided below 87 feet, NGVD. This combination represents a balanced approached toward addressing the short-term use and the long-term stability and productivity of wildlife resources and society's environment.

ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

210. Implementation of the recommended plan would irreversibly and irretrievably commit the lands and resources associated with the 62,500 acres of reforestation. These lands would have to remain in a forested condition. Normal silvicultural practices would be allowed. The recommended plan also commits labor and material, planning and technical expertise, and monetary resources.

LIST OF PREPARERS

211. A list of preparers is shown in Table SEIS-43.

TABLE SEIS-43
LIST OF PREPARERS

Name	Discipline/ Expertise	Experience	Role in Preparing SEIS or Supporting Appendixes
Jeff Artman	B.S., Mechanical Engineering M.S., Engineering Management	12 years, Mechanical Engineer, 4 years, Value Engineer, U.S. Army Corps of Engineers	Mechanical design-pumps and prime movers
Terry Baldridge	B.S., Agricultural Economics M.S., Agricultural Economics	6 years, Research Associate, 6 years, Regional Economist, U.S. Army Corps of Engineers	Analysis of structure damages
Larry Banks	B.S., Agricultural Engineering	30 years, Hydraulic Engineer, currently Chief, Hydraulics Branch, U.S. Army Corps of Engineers	Review of H&H analysis and technical appendix
Billye Barfield	Civil Engineer Technician	22 years, Planning, Programs and Project Management Division, U.S. Army Corps of Engineers	Report assembly
Charles Baxter	B.S., Wildlife Science	29 years, Conservation Planning and Implementation, U.S. Fish and Wildlife Service	Team Leader
Jeannine Beatty	Administrative Support Clerk	3.5 years, Social Security Administration, 20 years, U.S. Army Corps of Engineers	Report preparation
Jerry Bolton	Biology/Ecology	13 years, NEPA and related studies, Gulf South Research Corporation	Data collection, pondberry report review
Tonya Bolton	Biology/Wildlife Management	1 year, NEPA and related studies, Gulf South Research Corporation	Data collection, pondberry report
Tad Britt	B.S., History M.A., Anthropology	5 years, Consulting Archeologist, 6 years, Archeologist, U.S. Army Corps of Engineers	Cultural resources
Robert Burke	B.S., Agricultural Economics M.S., Agricultural Economics	1 year, Real Estate Appraiser, 4 years, Economist, 15 years, Regional Economist, U.S. Army Corps of Engineers	Review of Economics Appendix and supporting attachments, prepared impacts assessment attachment
John Burnworth	B.S., Civil Engineering M.S., Civil Engineering	3 years, Structural Engineer, 22 years, structural engineer, U.S. Army Corps of Engineers	Structural ITR team member
Marvin Cannon	B.S., Biology	24 years, Biologist, U.S. Corps of Engineers	Technical Review
Brian Chewning	B.S., Agricultural Economics M.S., Agricultural Economics	4 years, Economist, 2 years, Regional Economist, U.S. Army Corps of Engineers	Prepared Agricultural Risk and Uncertainty Attachment
Sherri Clemens	B.S., Civil Engineering M.S. Civil Engineering	2 years, Civil Engineer, Pan Am World Services, 3 years, Research Engineer, CEWES, 11 years, Project Engineer, 1 year, Civil Engineer, U.S. Army Corps of Engineers	Engineering Division coordinator
Jay Cline	Biology/Ecology	3 years, NEPA studies, Gulf South Research Corporation	Data collection, pondberry report
Billy Cook	Associate Degree, Applied Science	27 years, Engineering Services/ Surveying	Survey Manager
Myra Dean	Editorial Assistant	24 years, U.S. Army Corps of Engineers	Report preparation
Phil D. Dye	B.S., Civil Engineering	3 years, Mississippi Department of Transportation, 12 years, Hydraulics and Hydrology and Information Management, U.S. Army Corps of Engineers	GIS
Paul Eagles	B.S., Civil Engineering	13 years, Planning and Project Management, U.S. Army Corps of Engineers	Technical Review Team Leader

TABLE SEIS-43 (Cont)

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Marty Garton	B.S., Ag Engineering M.S., Civil Engineering	28 years, Study Manager, 2 years, Senior Project Manager, U.S. Army Corps of Engineers	Team Leader and Main Report Preparation
Bobby Gilliam	B.S., Agricultural Economics	1 year, Statistician, CSRS, 8 years Economist, 11 years, Regional Economist, U.S. Army Corps of Engineers	Conducted analysis of rural and urban structures damages.
Ron C. Goldman	B.S., Civil Engineering	22 years, Water Control, Hydrology and Information Management, U.S. Army Corps of Engineers	Hydraulic design team member
Phil Hegwood	B.S., Engineering	25 years, U.S. Army Corps of Engineers	Cost Engineering
Tom Hill	B.S., Agricultural Economics M.S., Agricultural Economics	2 years, Economist, Natural Resource Conservation Service, 19 years, Regional Economist, U.S. Army Corps of Engineers	Senior Economist, prepared Economics Appendix
Robert Hite	BSME, Mechanical Engineering	2 years, Mechanical Engineer, U.S. Army Corps of Engineers	Evaluated existing gate machinery and performed gate machinery design
Chris Ingram	Biology/Ecology	22 years, NEPA and related studies, Gulf South Research Corporation	Project Manager, pondberry report
David Jenkins	B.S., Civil Engineering	6 years, Cost Engineering, U.S. Army Corps of Engineers	Cost estimates
Dan Johnson	B.S., Civil Engineering	26 years, Planning, Programs, and Project Management Division, U.S. Army Corps of Engineers	Supervision of overall document development
David Johnson	B.S., Biology	16 years, Environmental Engineer, currently Chief, Water Quality Section, U.S. Army Corps of Engineers	Water Quality team leader, prepared Water Quality Appendix, and geographic information system mapping-stage area curve development
Jack Killgore	Ph.D., Biology	20 years, Research Fishery Biologist, U.S. Army Engineer Research and Development Center	Aquatic Appendix
Wendell King	B.S., Biology M.S., Biology	3 years, Biologist, Mississippi Department of Environmental Quality, 20 years, U.S. Army Corps of Engineers	Section 404(b)(1) Evaluation and Endangered and Threatened Species
Fred Lee, Jr.	BSME, Mechanical Engineering	5 years, Reactor Plant Overhaul Engineer, Ingalls Shipbuilding, Pascagoula, MS; 26 years, mechanical engineer, U.S. Army Corps of Engineers	Senior Mechanical Design Engineer
Edna Lee-Jackson	AAAS, Hinds Community College	23 years, Program Analyst, U.S. Army Corps of Engineers	Funds management
Cindy Lyons	B.S., Economics	18 years, Economist, 4 years Regional Economist, U.S. Army Corps of Engineers	Prepared Structural Risk and Uncertainty Attachment

TABLE SEIS-43 (Cont)

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Larry Marcy	M.S., Wildlife and Fisheries Science	8 years, Fish and Wildlife Biology, Wetland Biology, U.S. Fish and Wildlife Service	Coauthor and Project Biologist
Rose McCullough	Editorial Assistant	10 years, U.S. Army Engineer Research and Development Center; 24 years, U.S. Army Corps of Engineers	Report preparation
Charles McKinnie	B.S., Civil Engineering	3 years, Civil Engineer, 17 years, Hydraulic Engineer, U.S. Army Corps of Engineers	Hydraulic Branch Team Leader, prepared H&H appendix
Curtis McMurl	M.S., Zoology	4 years, Fish and Wildlife Biology and GIS Applications, U.S. Fish and Wildlife Service	GIS Data Analysis
John Meador	B.S., Civil Engineering	15 years, Hydrologic Engineering, 10 years, Senior Project Manager, U.S. Army Corps of Engineers	Agency Coordination
James Merritt	B.A., Biology/German J.D., University of Mississippi, Certificate in Environmental and Natural Resources Law	4 years, General Attorney	Reviewer
Ron Nassar	Ph.D., Wildlife and Fisheries Sciences	9 years, Wetland Management and Rehabilitation, U.S. Fish and Wildlife Service	Technical Advisor
Sharon Newman	GIS/Graphics	7 years, GIS analysis, Gulf South Research Corporation	Graphics and GIS, pondberry report
Kent Parrish	B.S., Ag Engineering M.S., Business Admin	7 years, Asst Project Engineer, Soil Conservation Service, 12 years, Study Manager, 4 years, Senior Project Manager, U.S. Army Corps of Engineers	Team Leader and Main Report Preparation
Allen Perry	B.S., Civil Engineering	22 years, Civil/Structural, U.S. Army Corps of Engineers	Reviewer Structural Design
Fred Pinkard, Jr.	B.S., Civil Engineering M.S., Civil Engineering	14 years, Civil Engineer, 4 years, Hydraulic Engineer, U.S. Army Corps of Engineers	Water Quality
Bill Roberts	B.S., Vocational Agricultural	22 years, Real Estate Appraiser	Real Estate
Rick Robertson	B.S., Civil Engineering	1 year, Civil Engineer, 25 years, Hydraulic Engineer, U.S. Army Corps of Engineers	Independent Technical Review Team
Lee Robinson	B.S., Agricultural Economics	4 years, loan officer, FmHA, 2 years Economist, 9 years Regional Economist, U.S. Army Corps of Engineers	Technical Review
Tommy Runnels	Hydrologic Technician	18 years, Survey, 11 years, Hydrologics	Computer graphics/survey party coordinator
Carolyn Schneider	B.A., Biology M.A., Fisheries	Environmental Lab, U.S. Army Engineer Research and Development Center, 14 years, 4 years, U.S. Army Corps of Engineers	Wetland Appendix
John Segrest	B.S., Agricultural Economics M.S., Agricultural Economics	22 years, U.S. Army Corps of Engineers, 19 years, Appraisal, 3 years, acquisition	Real Estate Cost Estimates
Steve Smith	Range Conservation	8 years, NEPA and T&E surveys, Gulf South Research Corporation	Data collection, pondberry report

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Sam Stacy	B.S., Civil Engineering M.S., Civil Engineering	17 years, Geotechnical Engineer, U.S. Army Corps of Engineers	Geotech Team Leader
Barry Sullivan	B.S., Civil Engineering	5 years, Hydraulic Engineer, 6 years, Environmental Engineer, U.S. Army Corps of Engineers	Water Quality, geographic Information System mapping
Thomas Tucker	B.S., Civil Engineering M.S., Engineering	3 years, co-op, engineer in training, 20 years, Structural/Civil Engineer, U.S. Army Corps of Engineers	Structural/Civil Design Team Member
Michael Turner	B.S., Civil Engineering	4 years, Production Engineer, McDermott Inc., Morgan City, LA, 17 years, Structural Engineer, U.S. Army Corps of Engineers	Surveys and mapping
William Uihlein	Ph.D., Forest Resources	3 years, Landscape Migratory Bird Conservation Planning, U.S. Fish and Wildlife Service	GIS Data Analysis and Technical Advisor
Robert Ulmer, Jr.	B.S., Geology	4 years, Hydrologic Engineering Technician, 9 years, Geologist, U.S. Army Corps of Engineers	Regional and site geology
Jim Wakeley	Ph.D., Wildlife Biology/Wetlands	10 years, Associate Professor of Wildlife/Ecology, Penn State University, 14 years, Research Wildlife Biologist, U.S. Army Engineer Research and Development Center	Terrestrial Appendix
David Wallace	B.S., Civil Engineering M.S., Environmental Engineering	10 years, Environmental Engineer, U.S. Army Corps of Engineers	HTRW Team Leader. HTRW and water quality
Ramona Warren	B.S., Biology	4 years, Natural Resources Conservation Service, 19 years, Biology, U.S. Army Corps of Engineers	Biological assessment
Russ Watson	B.A., Biology	25 years, Fish and Wildlife Biology and Ecological Sciences, U.S. Fish and Wildlife Service	Author and Technical Advisor on FWCA
Michael Weiland	B.S., Civil Engineering	23 years, Structural Engineer, U.S. Army Corps of Engineers	Structures Team Leader
Ken White	B.S., Business	26 years, Real Estate Appraiser	Real Estate
Tim Wilkins	B.S., Wildlife Management	29 years, Wildlife Management, Wetland Restoration, U.S. Fish and Wildlife Service	Assistant Team Leader and Technical Advisor
Sheyna Wisdom	Biology	4 years natural resources and NEPA studies, Gulf South Research Corporation	Data collection and analysis, pondberry report preparation
Robert Wood	B.S., Real Estate	14 years, Real Estate Appraiser, U.S. Army Corps of Engineers, 10 years, private sector	Real Estate Cost Estimates
Gary Young	B.S., Forestry/Wildlife Management M.S., Forestry	9 years, Biologist, currently Environmental Team Leader, U.S. Army Corps of Engineers	SEIS preparation, project biologist, NEPA
Jeannette Younger	Associate of Science, Drafting and Design	Civil Engineering Technician, U.S. Army Corps of Engineers	Drawings

PUBLIC INVOLVEMENT, REVIEW, AND COORDINATION

PUBLIC INVOLVEMENT

212. A Notice of Intent to prepare a draft SEIS was filed on 6 October 1993. A public scoping meeting was held in Rolling Fork, Mississippi, in November 1993. The meeting was advertised in the local newspaper, and 50 people attended the meeting, excluding Corps and cooperating agency personnel. Extensive briefings, meetings, and workshops were conducted to help identify and modify alternatives and build a consensus among interested parties (see PRELIMINARY SCREENING section and Table SEIS-2).

COOPERATING AGENCIES

213. The U.S. Fish and Wildlife Service and the Mississippi Department of Wildlife, Fisheries and Parks served as cooperating agencies. Cooperating agencies assisted in the development and preparation of environmental analyses, resource documentation and the SEIS. The degree of involvement varied by agency. Contributions included:

a. NEPA and scoping process.

b. Professional expertise, study direction and technical analysis.

c. Aquatic and terrestrial HEP team participation.

d. Meeting and field trip participation.

e. Document and technical appendixes review.

214. Extensive coordination activities including letters, interagency meetings, field trips, public presentations and meetings, workshops, committee meetings, and opportunities for review and comment were conducted during the reformulation study. The Main Report, draft SEIS, Mitigation Report, and Section 404(b)(1) Evaluation (Volume 1) and supporting documentation (Volumes 2 and 3) were sent for review and comment (45 days) to the following agencies, organizations, groups, and persons:

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Libraries

Homochitto Valley Library
Service
220 South Commerce
Natchez, Mississippi 39120

Carnegie Public Library
114 Delta Avenue
Clarksdale, Mississippi 38614

State Library of Louisiana
Louisiana Section
760 North 3rd Street
Baton Rouge, Louisiana 70802

Warren County/Vicksburg
Library
700 Veto Street
Vicksburg, Mississippi 39180-3595

Washington County Library
341 Main Street
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